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WORLD PETROLEUM

NEW YORK AND LONDON

JANUARY 1938

OUTLOOK FOR 1938 SURVEYED BY OIL INDUSTRY EXECUTIVES.

FIVE YEAR FINANCIAL REVIEW.

ROUMANIA TO EXPORT LESS REFINED PRODUCTS.

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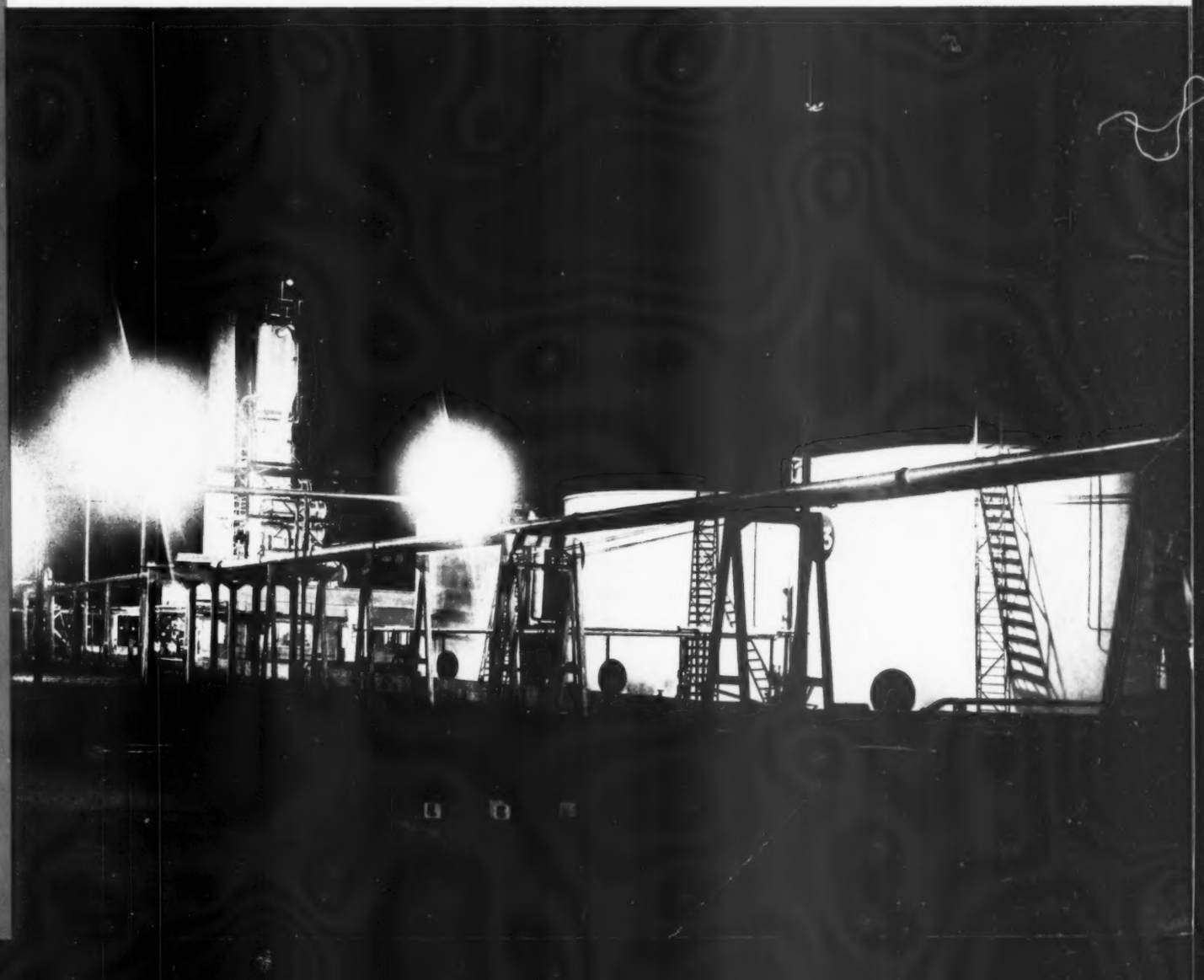

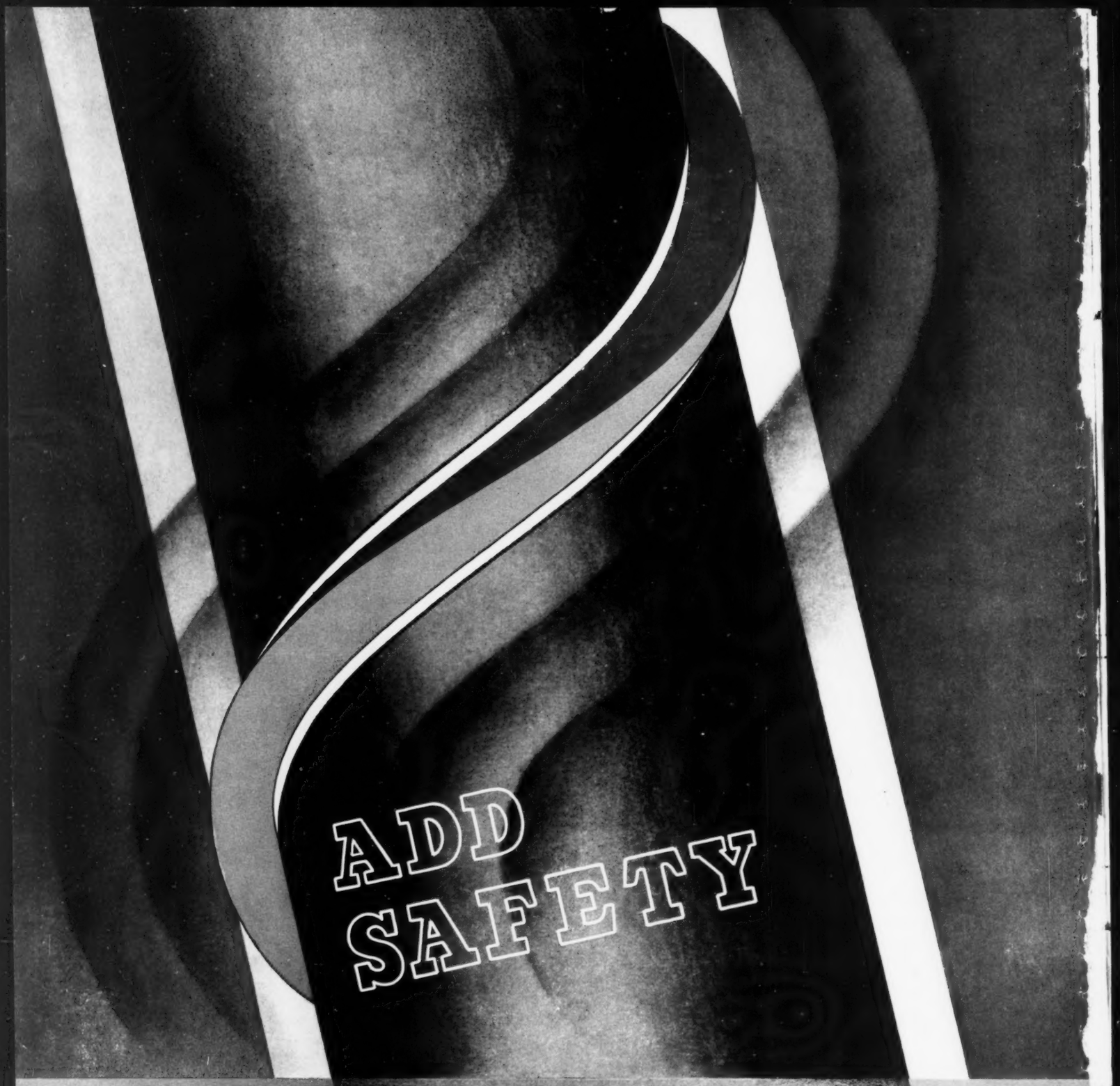

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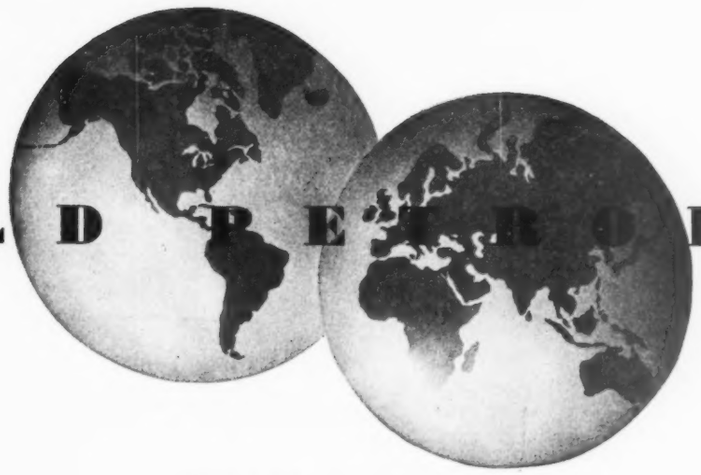

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RUSSELL PALMER
Publisher

E. W. Mayo
Editor

T. Orchard Lisle
Executive Editor

E. W. Mayo, Jr.
Managing Editor

S. J. Gallay
Advertising Manager

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CORRESPONDENCE

ADDRESS all correspondence regarding subscription and business matters to the Home Office; 95 River Street, Hoboken, N.J.

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Necessity for new sources of production has increased the number of wildcat wells drilling in the world to a new high—a scene in South Texas

EDITORIAL

LOOKING TOWARD 1938

BECAUSE the United States is, of all nations, both the largest producer and the greatest consumer of petroleum products conditions existing in this country inevitably affect the industry as a whole. Because business in the United States is in a disturbed and perplexing state the prospect before those industries which are the principal users of oil and its products—and hence that of the oil trade itself—is clouded with uncertainty at a time when it should be entering upon the period of its greatest activity and usefulness.

For these reasons World Petroleum, in its first issue of 1938, has assembled the views of representative men identified with various fields of oil industry activity in an effort to interpret the situation and the immediate outlook. It commends to its readers a careful perusal of these opinions and particularly of the searching study of existing conditions by the country's leading petroleum economist. The clearly pointed conclusion to be drawn from Mr. Pogue's analysis of current trade statistics is that it is easier—and far safer—to avoid the waste and injury of excessive output than to repair the damage that it is certain to cause. This is a simple statement of the case but past experience has shown that just this simple truth needs reiteration at junctures like the present one.

The oil industry cannot control or change the current of general business. By the exercise of sound judgment on the part of those who guide proration activities in the principal producing states, backed by the cooperation of oil producers themselves, it can adjust itself to that current. That really is what the present situation calls for.

It is to be noted that among all the expressions quoted in the following pages none is in an alarmist key. None goes further than to sound a warning note as to the importance of observing the signs that are clearly posted along the highways of trade and industry. This is as it should be. Politicians come and go but industry goes on, checked now and again, but not halted, creating and satisfying ever new wants. That is the basis of civilized progress. When the process is changed progress ends and civilization falters.

Fortunately oil is international. It flows to the places where activity is greatest. Looking upon the international scene one finds a striking contrast to domestic uncertainty. There is no sign of stagnation or recession in the world movement of petroleum. Industrial activity is intensified, transport facilities are being swiftly expanded, motorization of once backward lands moves at an accelerating rate. Oil is the only power that can sustain this increasing momentum. The cry, therefore, is constantly for more and more oil. While supplies outside the North American continent have increased greatly in the past few years demand has risen still more rapidly. That is why the export of petroleum products from the United States, which five years ago seemed destined to a steady decline, have expanded each year since.

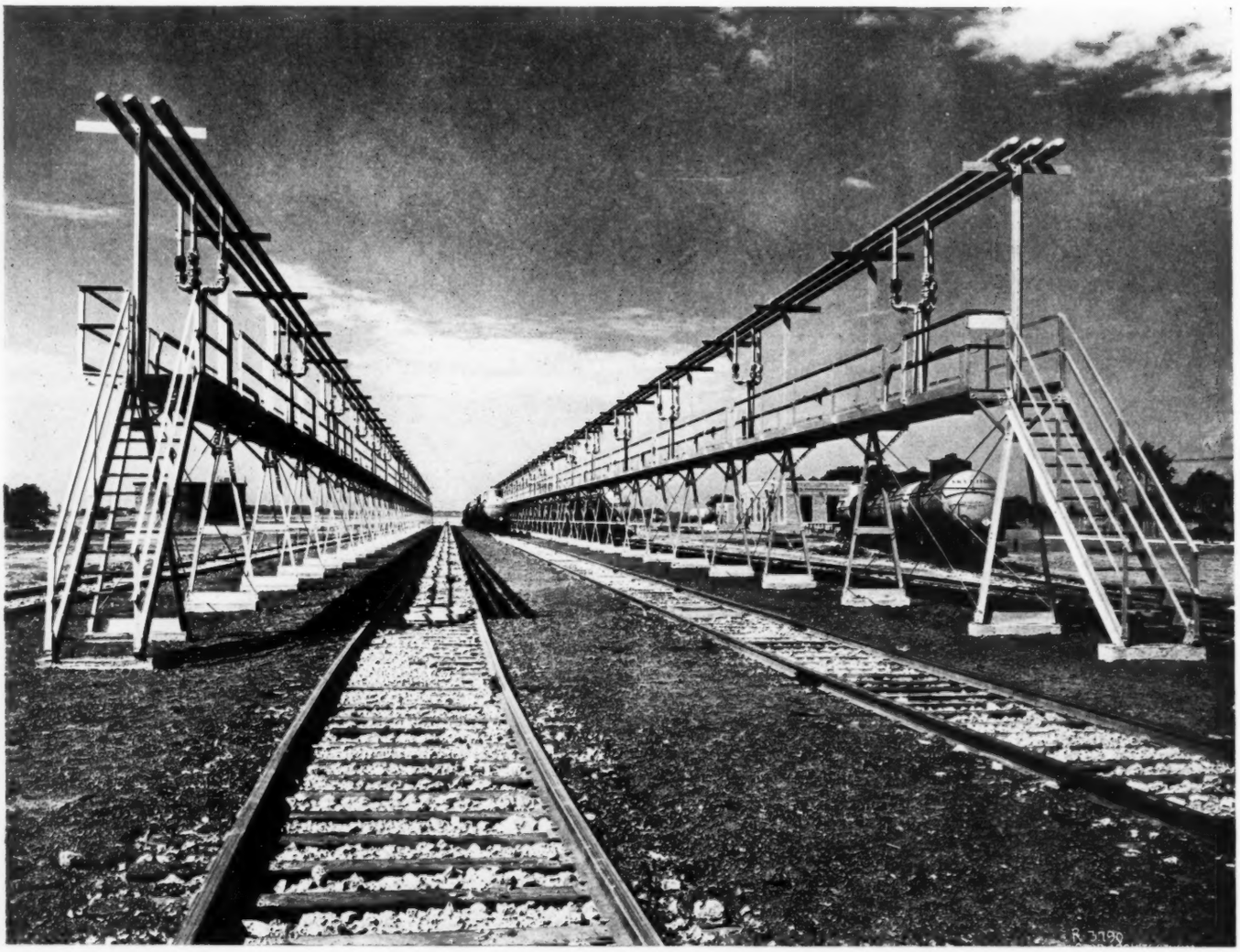
In the United States itself such unsettlement as exists is due to removable causes and hence will not persist indefinitely. The very factors that produce trade depression carry with themselves the seeds of recovery. And unless the oil industry grows the country as a whole cannot continue its growth.

During 1937 noteworthy additions were made to the country's known reserves of oil, not because they were required at the moment but because they will be needed in the years that lie just ahead. Nobody who is well informed expects to see any material slackening in exploration and drilling, in the provision of new transport facilities or in the improvement of refining processes and equipment during the present year or during those which will closely follow. The structure of the industry is being built not for a day, but for an age and the sure knowledge of future needs will keep it rising.

THE OUTLOOK for the Petroleum Industry in the First Half of 1938

By Joseph E. Pogue

Vice President, The Chase National Bank of the City of New York



IN THE latter half of 1937 the American petroleum industry entered a period of business recession at top speed. Without warning, or at least without advance signals visible to most, the general economy declined suddenly and precipitously. The oil business found itself forthwith faced with the necessity of adjusting its operations to a more temperate pace and of shaping its program to an altered objective of unknown position. The manner in which the initial accommodation to this change has been accomplished could be studied with considerable interest, but of greater moment would be the establishment of guideposts marking the course ahead. The purpose of this article is to present such analyses of the near-term outlook as the writer has been able to formulate in an atmosphere of low visibility.

May it be clearly understood that the intention here is not to set forth specific forecasts of economic conditions and supply-demand relationships, which doubtless cannot be done accurately; but rather to analyze the factors that will circumscribe the operations of the oil business and attempt, by so doing, to arrive at a better understanding of the steps leading to renewed equilibrium and stability.

At the time of impact with the business recession, the oil industry had acquired great momentum. Those of us who recall our physics will remember that momentum is the product of mass and velocity. Hence an examination of the size and rate of

[1] The writer is indebted to Norman D. Fitz Gerald, department of petroleum economics, The Chase National Bank, for assistance in the preparation of the statistical analyses upon which this paper is based.

change in a few key elements in the oil situation will convey some measure of the impetus last summer. Taking as the basis of comparison the first ten months of 1936 and 1937, we find that the domestic production of crude oil had increased from 2,983,000 bbl. to 3,509,000 bbl. per day, or 17.6 percent; runs to stills, from 2,905,000 bbl. to 3,242,000 bbl. daily, or 11.6 percent; consumption of motor fuel, from 1,395,000 bbl. to 1,542,000 bbl. daily, or 10.5 percent; consumption of gas and fuel oil, from 1,174,000 bbl. to 1,310,000 bbl. daily, or 11.6 percent; and number of wells completed, from 20,939 to 27,554, or 31.6 percent. As a result of the greatly augmented drilling, more oil has been blocked out than in the previous year: In 1936 the estimated discoveries were about 90 percent of the year's production, whereas in 1937 the corresponding ratio may have reached 140 to 150 percent.

Between August 28th and December 18th (the date of this analysis), considerable adjustment was accomplished by the oil industry. As a result of vigorous action on the part of the regulatory authorities, crude oil production was curtailed from levels of 3,731,000 bbl. to 3,440,000 bbl. daily, with the possibility of further reductions needed to balance supply and demand. Under the impetus of declining prices for gasoline and for nearly every other product except heating oils, resulting in a sharp drop in the refiners' realization, the volume of crude run to stills declined from 3,425,000 bbl. per day to 3,220,000 bbl., with the retarding influences still at work. What then should be the course of still runs and domestic crude oil production during the first half of 1938 on the basis of a balanced program, that is, one that will lead to a condition of stability? In order to throw light on this problem, we have to consider the degree of equilibrium existing in the oil industry at the close of 1937, and the prospects for consumption during the first half of 1938 which, of course, will be dependent in part upon business conditions.

In 1937 our domestic oilfields produced an average of 3,498,000 bbl. per day[1]. This volume involved some overproduction, for both crude oil and motor fuel were added to storage. Inventories of domestic crude oil increased 15,100,000 bbl. or at an average daily rate of 41,000 bbl. Also 13,200,000 bbl. of motor fuel went into storage during the year, which represents a crude oil equivalent of 29,900,000 bbl., or 82,000 bbl. per day. If the assumption is made that the cause of equilibrium would have been better served with no net additions to stocks of either crude oil or motor fuel, then by deducting the increments from the volume actually produced we find that the adjusted crude oil requirement for 1937 was 3,375,000 bbl. per day, or 123,000 bbl. daily less than what was actually brought to the surface. Perhaps for the time being we can ignore the small volume of crude oil placed in tanks during 1937, but the same treatment can scarcely be accorded to the 13,200,000 bbl. of motor fuel actually produced but withheld from the stream of consumption because there was no demand for it. This volume should properly be looked upon as advance production for 1938 which cannot be again manufactured in 1938 without loss of equilibrium. Expressed another way, 13,200,000 bbl. of motor fuel is 2.35 percent of the total 1937 consumption of this commodity, and hence 2.35 points of whatever percentage increase in motor fuel demand that 1938 has in store has already been allowed for in the 1937 operating schedules.

As to business conditions, we may visualize this factor in terms of the widely used Federal Reserve Index of Industrial Production. This index in 1937 displayed the trend indicated by Table I.

TABLE I

FEDERAL RESERVE INDEX OF INDUSTRIAL PRODUCTION

1937—1st Quarter	116
2nd Quarter	117
3rd Quarter	114
4th Quarter	96*
Dec. 15th	91*

* Estimated and checked by weekly indexes.

While it would be obviously impossible to forecast with accuracy the level of this index in the first half of 1938, it is nevertheless clear that a level of 95, for example, would involve some recovery from the year-end activity. Let us assume for the basis of demand calculations that this index will average 94 in the first and second quarters of 1938. In such event, the probable gasoline demand will be as shown in Table II (see also Table V).

TABLE II

PROBABLE DAILY GASOLINE DEMAND

	1938	
	Jan.-Mar.	2nd Quarter
Federal Reserve Index of Industrial Production.	94	94
	(barrels)	
Domestic Consumption of Motor Fuel.	1,232,000	1,552,000
Exports of Motor Fuel	98,000	108,000
Total Consumption	1,330,000	1,660,000
Total, Year Ago	1,270,000	1,612,000
	(Percent)	
Percent Change	+4.7	+3.0

In this table the estimate of the export demand is hardly more than an informed guess, but the assumptions given appear reasonable.

If these figures for motor fuel consumption are accepted, it then becomes possible to compute the required volume of crude oil to be run to stills, and to be produced. These calculations involve estimates of gasoline recovery, production of natural gasoline and benzol, exports of crude oil, and utilization of crude as such, all of which are subject to more or less variation under changing conditions. Even allowing for all these elements, the calculations cannot be carried through unless an inventory objective for motor fuel is assumed. In 1937 the motor fuel carry-over into April was 79,000,000 bbl.[2]; and the carry-over into July, 73,900,000 bbl. It will perhaps be generally conceded that these carry-overs are ample for 1938. Suppose, then, that we attempted to set up our calculations with the objective of, say, 80,000,000 bbl. of motor fuel to be in stock on March 31st, 1938. On this basis, for the first quarter of 1938, the volume of crude oil required to be run to stills would be 2,900,000 bbl. per day, and that to be produced, 3,078,000 bbl. per day.

The deduction to be drawn from this computation is that it is impracticable to liquidate the motor fuel situation to an equilibrium position in so short a time as three months. To do so would require too severe a contraction in the operations of the industry: the proration machinery would be severely taxed and heating oil commitments could not be easily met. A longer period than three months is necessary. Let us draw up another set of figures based upon an objective of 87,000,000 bbl. of motor fuel to be in storage on March 31st, but only 75,000,0000 bbl., on June 30th—a program that would extend the liquidation into the second quarter. On this basis, the crude oil requirements would work out as given in Table III.

TABLE III

	1938	
	1st Quarter	2nd Quarter
	(barrels)	
Motor Fuel Demand (Daily)	1,330,000	1,660,000
Inventory Objective	87,000,000	75,000,000
Inventory, Year Before	79,000,000	73,900,000
Required Runs of Crude to Stills (Daily)	3,082,000	3,180,000
Required Production Domestic Crude (Daily)	3,260,000	3,340,000

Examination of this table indicates that such operating schedules, while calling for substantial curtailment in the first quarter and only very moderate expansion during the second quarter, are nevertheless feasible and would provide a close approach to motor fuel equilibrium by the middle of the year. In respect to the effect of such levels on the heating oil situation, an upward adjustment in the yields of heating oils would have to be made, but the flexibility of refining processes is such as to make this accommodation appear entirely possible. Contrariwise there is risk that the failure on the part of refiners to force their yields of heating oils this winter may lead to overproduction of gasoline.

To illustrate further the bearing of the

[1] All figures in this article, covering 1937 as a whole, involve estimates for the final part of the period and are subject to minor correction.

[2] In these calculations, stocks of motor fuel are the sum of finished gasoline and natural gasoline.

TABLE IV

	1937 1st Half	1938 1st Half	Percent Change
Motor Fuel Demand (Daily)	1,442,000	1,496,000	+ 3.7
Motor Fuel Inventory: Net Change	+13,600,000	+13,600,000	0.0
Actual, End of Period	73,900,000	87,100,000	+17.9
No. of Days' Supply†	51	58	+13.7
Required Runs of Crude to Stills (Daily)	3,132,000	3,263,000	+ 4.2
Required Prod. Domestic Crude (Daily)	3,427,000*	3,432,000	+ 0.1
Change in Stocks, Domestic Crude (Daily)	+ 114,000		

* Actual production.
† Basis of average consumption for the period.

motor fuel carry-over upon the required levels of refinery operations and oilfield output, we may compute the schedules that would result in the event that the net addition to motor fuel stocks in the first half of 1937 were paralleled in the corresponding period of 1938, thus carrying the motor fuel inventory to 87,100,000 bbl. by June 30th next. The setup on this basis is as in Table IV.

This tabulation indicates that for the first half of 1938 both runs to stills and production must average less than during the first half of 1937, if a very high carry-over of motor fuel into the summer, or else substantial additions to crude oil stocks, are to be avoided. For the week ending December 18th, 1937, runs to stills averaged 3,220,000 bbl. daily and production, 3,440,000 bbl. per day, which suggests, in comparison with the foregoing table, the difficulty of bringing the gasoline situation into balance at recent operating rates.

In conclusion, the following points may be brought together in summary form:

1. The oil industry entered the business recession with great momentum, but has already made headway toward readjusting its tempo to the new conditions.
2. Overrefining in 1937 left its legacy in the form of some 12—or 13,000,000 bbl. —of motor fuel which need not be made again in 1938, but on the contrary should be liquidated.
3. In view of the prospects for a dampened rate of expansion in motor fuel demand, the unbalancing effect of a large carry-over of motor fuel into the second half of 1938 can only be avoided by sharply restrained refinery and oilfield operations throughout the first half.
4. It is believed that it is impracticable to liquidate the gasoline overage during the first quarter of the year, the best that seems attainable being such an accomplishment by June 30th.
5. To gain this objective will require, all other things being equal, a crude oil production of 3,260,000 bbl. daily in the first quarter, and 3,340,000 bbl. daily in the second; with crude run to stills averaging, in the respective periods, 3,082,000 bbl. daily and 3,180,000 bbl. daily.

TABLE V

ANALYSIS OF THE OIL OUTLOOK FOR THE FIRST SIX MONTHS OF 1938 ON BASIS OF REDUCING THE PROSPECTIVE CARRY-OVER OF GASOLINE

		1937				1938*	
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter
Motor Fuel—Domestic Consumption	TBD	1181	1511	1603	1390	1232	1552
Exports	TBD	89	101	122	113	98	108
Total	TBD	1270	1612	1725	1503	1330	1660
Year Ago	TBD	1114	1462	1569	1421	1270	1612
Change	Percent	+14.0	+10.3	+9.9	+5.8	+4.7	+3.0
Change in Motor Fuel Stocks	MB	+18.7	—5.1	—9.6	+9.2	+13.5	—12.0
Actual Stocks, Current	MB	79.0	73.9	64.3	73.5	87.0	75.0
Actual Stocks, Year Ago	MB	71.7	66.3	56.3	60.4	79.0	73.9
Required Runs of Crude to Stills	TBD	3040	3224	3408	3319	3082	3180
Required Domestic Production Crude	TBD	3316	3536	3651	3495	3260	3340
Change in Crude Stocks‡	TBD	+105	+122	+3	—62	0	0

TBD Thousands of barrels daily.
MB Millions of barrels
* Final part estimated.
† These calculations are based upon what is regarded as a balanced program; i.e., no addition to crude oil inventories and an improvement in the inventory position of motor fuel. Higher operating schedules would be at the expense of equilibrium in respect to crude oil or motor fuel inventories, or both. For example, in the second quarter of 1938, runs of 3,305,000 bbl. daily and supporting production of 3,465,000 bbl. daily would result in a summer carry-over of motor fuel stocks of 80,000,000 bbl.
‡ Runs to stills plus crude exports plus crude as such minus crude production.

FAVORABLE WORLD OUTLOOK
for Oil Industry Entering 1938

International Demand Shows Unabated Growth — American Situation Sound If Overproduction Is Avoided — Views from Varied Angles Expressed by Oil Executives Sound Warning Without Undue Alarm.

WHILE 1937 was in many respects a banner year in the petroleum industry with the demand for products reaching new high levels and the earnings of many companies establishing the best financial record since 1929, the year ended on an uncertain note. The sudden and acute decline in industrial activity that took place in the United States during the final quarter of the year, the fact that production continued at a high rate and that stocks of gasoline increased above their usual figure in the later months caused many observers to view the immediate outlook with apprehension. Others maintained that unless the drop of business activity carried into an extreme decline such as occurred in 1932-33 the oil industry had little to fear and pointed out that the growth of consumption during 1936-37 called for a corresponding rise in stocks in order to maintain a normal relationship.

Widespread inquiry and a careful weighing of individual views leads to certain conclusions which may be taken as representative of a large body of opinion within the industry. These may be roughly summarized as follows:

(1) Production in the United States was not tapered off in step with the decline in consumption during the past three months. As a result crude stocks increased slightly and gasoline stocks attained a level that involved a menace to the stability of prices. The gasoline situation has been made more disturbing by the rise in demand

for heating oils which makes it probable that by April motor fuel supplies will be greater than at the corresponding period in any past season unless the ratio of gasoline recovery is lowered.

(2) Prosperity for business as a whole and for individual industries no longer depends upon members of the industries themselves, but is largely determined by the course of the federal government in relation to taxation, regulations and prosecution. With different departments of the government following contradictory policies in regard to these matters it is practically impossible for industry to chart a clear course.

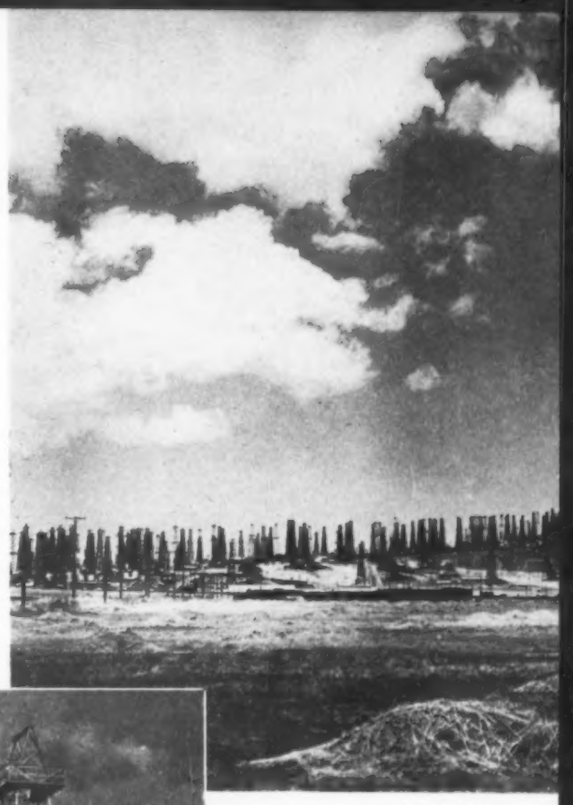
In the case of the oil industry it is recognized that its prosperity and stability depend in a large degree upon the action of regulatory bodies in the principal producing states. Since the whole structure of the industry depends largely upon the volume of crude production, the allocations of these regulatory bodies exercise greater influence than anything the members of the industry do. It is acknowledged, however, that the state commissions at the present time show a greater appreciation than in the past of the disastrous effects of overproduction and endeavor to prevent wasteful output.

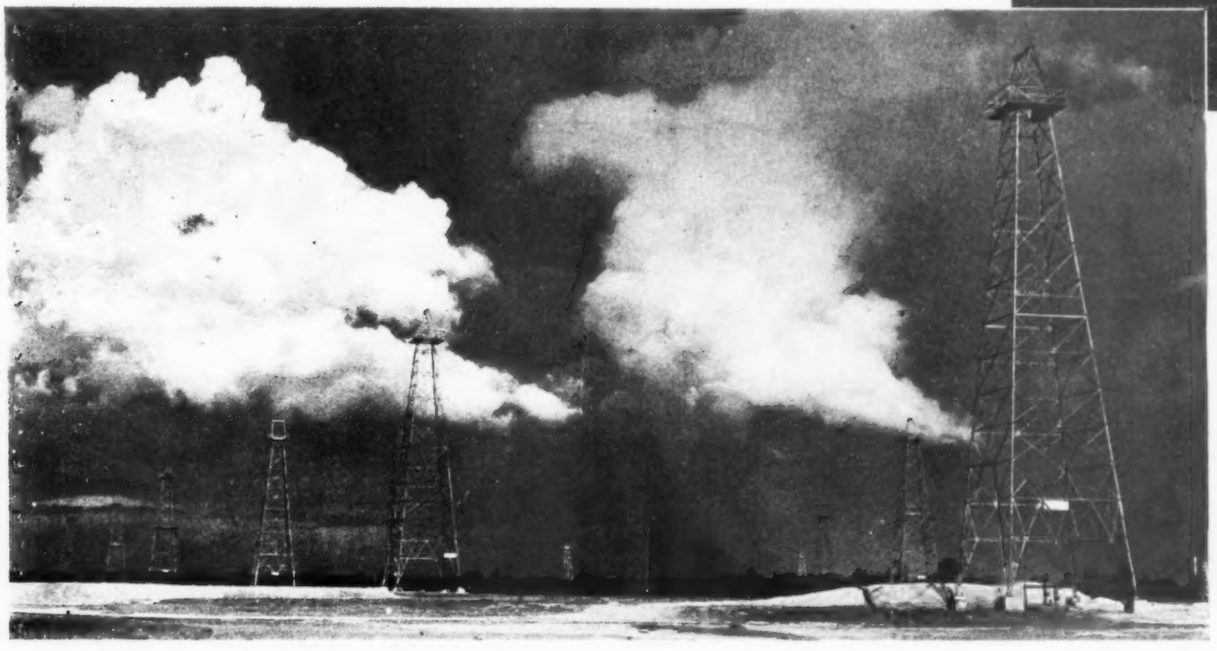
(3) Preponderance of opinion within the industry is that the recent rapid rate of increase in demand for motor fuel, amounting to 10 percent in each of the past two years, is not likely to be repeated in 1938. It is not anticipated that an actual falling of in consumption will occur but rather that a slowing down in the rate of growth to five percent or thereabouts is a reasonable forecast for 1938.

(4) Whatever the effect of outside factors upon marketing conditions there will be no let up in the pressure applied to exploration and drilling of wells nor in the modernization and extension of refining facilities. It is recognized that interruption in the upward trend of demand for petroleum products will be only temporary and that the problem before the industry from the long term point of view is to provide the supplies that a constantly broadening market will require from year to year.

(5) In the international field the outlook for the coming year is particularly strong. Outside the United States no sign appears of the industrial depression so much discussed here. The motorization of these countries is proceeding at an accelerating pace as has been the case even during those years at the depths of the depression when an actual decrease took place in America. Probably an undue importance has been attributed to war and preparation for war as explaining the expansion of demand for petroleum products in Europe and Asia. This has been a factor undoubtedly but a study of statistics indicates that commercial and industrial developments have been of much greater importance.

Under pressure for more and more oil a tremendous campaign of exploration, drilling and refinery expansion is being carried forward both in the Near and Far East and this campaign will be intensified during the coming year.





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Closely-spaced wells which were common in the United States a few years ago are outmoded by the oilfield of today—proration and scientific well-spacing with a view to obtaining the maximum production at a minimum of expense have done much to stabilize the American oil industry.

A. J. BYLES' STATEMENT

In a statement issued at the end of December, Axtell J. Byles, president of the American Petroleum Institute, reviewed the progress of the past year in the United States in the following terms:

"For the American petroleum industry, 1937 was a year of new records. It was outstanding also in that a high degree of orderliness prevailed despite unprecedented activity. Once again the industry's traditional ability successfully to meet the tests of changing conditions functioned to provide for its customers quality products and efficient service at reasonable prices.

"The nation's approximately 30,000,000 motorists used their vehicles to a greater extent than ever before, consuming more than 22,000,000,000 gal. of motor fuel. This volume is sufficient to propel their vehicles an aggregate distance of 330,000,000,000 miles, or about 80,000,000,000 miles farther than estimated travel in 1931, the pre-depression peak for road transport

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Intensive wildcatting is being carried out all over the world as oil demand continues to grow—above, drilling in the United States, Iran, Japan and Germany.

"Prices of petroleum products continued low, government indices indicating a level of nearly 40 percent below normal, as against an advance in the general commodity price level to within 11 percent of normal. Due to reductions in gasoline prices totaling 50 percent since 1920, some $3,000,000,000 was saved to motorist customers in 1937 alone. However, nearly a third of these savings was taken from them in federal and state gasoline sales taxes which, estimated at close to $1,000,000,000, also established a new record.

"Employment and pay rolls improved. Generally speaking, the industry's employes continued to be among the highest-paid industrial workers.

"Relatively stable crude oil prices and continuing large production brought a measure of prosperity to the oil-producing areas. Domestic crude oil production for 1937 is estimated at 1,280,000,000 bbl. as against 1,098,516,000 bbl. in 1936, until now the all-time peak year. Approximately 7,000 more wells were drilled in 1937 than in 1936. Total completions, estimated at 32,500 wells, were only slightly fewer than in the record year, 1920. Of these wells, 26,200 were productive either of oil or natural gas.

"Production, discoveries, and completions were such during the year that reserves of petroleum in the United States remain at a satisfactory level. Improvements in drilling and production technique, the restoration of older fields and prolongation of the productive life of newer oil areas, plus the functioning of state conservation laws under the guidance of the state officials aided by the Interstate Compact Commission, augur well for the future.

"Additional confidence may be found in progress in the science of refining, with more and better refined products being obtained from given quantities of crude. During 1937, with demands at new peaks, refiners ran to stills 1,180,000,000 bbl. of crude oil, or only slightly more than 100,000,000 bbl. above 1936. Crude oil stocks, as of December 31st, 1937, are estimated at 302,000,000 bbl. up about 10 percent from 1936, and some 107,000,000 bbl. below the all-time peak, October 31st, 1929."

NO NEW LAWS NEEDED

State regulation has assumed a place of special importance in the oil industry of the United States. The following expression from Col. Ernest O. Thompson, chairman of the Interstate Oil Compact Commission and member of the Texas Railroad Commission, presents the situation from the viewpoint of the general public interest. Col. Thompson says:

"The outlook for the oil industry in 1938 is good.

"It is good because the oil industry has the co-ordination and co-operation that makes accurate statistical data available weekly to the public through the press.

"The amount of oil consumed is known. The quantity of oil produced is known. And the amount of crude oil and finished petroleum products on hand in storage is made public through the press every week.

"The oil producing states have adequate laws to regulate production to market demand to prevent physical waste of oil in storage.

"Through the efficient and intelligent efforts of the Interstate Oil Compact the oil producing states have limited production reasonably to avoid unnecessary and wasteful overproduction.

"This regulated rate of production conserves the reservoir energy and means that far greater ultimate recoveries will be had from the oilfields so restricted.

"A new survey of the nation's oil reserves will show that this conservation effort will mean several additional hundred millions of barrels of oil ready for production as needed.

"The sovereign oil states have seen their duty clearly and have acted courageously in this matter. The result is that today American production of oil is about in balance with consumption.

"There are perhaps ten million barrels too much gasoline in storage caused by refiners making heating oil and having to store the resultant gasoline during the winter period.

"Reduced allowables in a firm market cause extensive and intensive drilling. But that is a matter for the driller or the operator to decide, as to whether or not he will make a profit out of the enterprise. It is not a subject for the use of the strong arm of government.

"I expect to see continued heavy drilling throughout 1938 unless we have a depression.

"To date 27,292 wells have been completed in the United States; of these, 14,157 were in Texas.

"There is no need for any new legislation on oil.

"The outstanding development of 1937 in oil regulation has been the realization of oil producers that strict effective state control of production was to the benefit of the nation, that it gave consumers cheap gasoline, and that it helped them by keeping them from overproducing themselves into bankruptcy. Consumption of gasoline in 1938 will, I believe, increase about six percent over 1937."

REDUCE STOCKS

A note of warning against too great expansion of crude and gasoline stocks in view of general business conditions is sounded by many conservative members of the industry. This point of view is well expressed by president Edward G. Seubert of Standard Oil Company of Indiana.

"In looking back at 1937," says Mr. Seubert, "we are struck particularly by the fact that there was a large increase in demand for products. Latest Bureau of Mines figures show the gain at nearly 9 percent. That demand provided a basis for good business and more employment and, with other factors, enabled fitting returns to be earned and high wages to be paid. If it were not for the current business recession the year would seem to have been one of the industry's best.

"During much of the year production was on a larger scale than consumption. In consequence, larger stocks of crude oil have been built up. Whether they will prove menacing to the market remains to be seen. Possibly they are less dangerous than the increase in stocks of gasoline. Some analysts will feel that the increase in demand offsets these increases in stocks but we should rather see the reserves held down to old proportions or reduced somewhat.

"In view of the great uncertainty which the general recession in business has injected into the situation it would be foolhardy to risk much of a prediction regarding the future, but we are inclined to hope and believe, on the basis of statistical computations, that the increase in demand for products will continue into 1938, though possibly at a slackening rate. The price trend will probably be more susceptible to change."

In similar vein W. S. Farish, president of Standard Oil Company (New Jersey) writes:

"There is some tendency in the industry to overproduce its markets, even with the quickened demand, and the end of 1937 will see gasoline inventories increased to levels considerably higher than sound economy dictates. It appears likely that we will enter the gasoline-consuming season in 1938 with 93,000,000 bbl. of gasoline in storage, 12,000,000 bbl. more than the wholly adequate stocks we had on hand at the corresponding date in 1937.

"The satisfactory prices received by the industry in 1937 probably reflect the active state of industry in general through most of the year. It is worth while to note in this connection that gasoline users are still able to fill their tanks at prices (excluding tax) lower than prewar levels. This statement can be made of few other commodities.

"All through the depression the industry has continued to increase investment and to engage in new construction. The year just ended has witnessed greatly increased operating and capital expenditures. The demand for greater quantities of products of improved quality has made this expansion imperative and the end is not yet. With an investment already amounting to some $13,000,000,000 the industry faces the prospect of continued large capital outlays through 1938. Its normal business, therefore, will necessitate substantial purchases of material and wide employment of labor during the coming year."

BUSINESS REASSURANCE

Stating a view that is finding widely increasing expression J. Howard Pew, president of Sun Oil Company, points out that the immediate future depends more upon the action of legislators and public officials than upon anything that industry itself can do. He says:

"Analyses of business conditions at the turn of the year are inevitably directed rather toward the future than to reviewing what is behind us. Even in times when conditions seem most auspicious, business prophecy is of doubtful value; in conditions such as now prevail its usefulness is a good deal less apparent. Even the wisest analysts are still debating whether we have run into a depression or merely a recession; but there is pretty general agreement that we have run into something that is not good for business. More accurately it should perhaps be said we have been pushed into it by a combination of factors including international relationships, widespread social unrest, economic uncertainties and, most important of all, the insistent efforts of our political doctors to treat disorders that they don't understand with remedies that at best are experimental, or at worst have repeatedly been proved the sheerest quackery.

"At a time when business was getting on reasonably well, and needed most to be let alone, this new school of experimentors saw their chance to revise the rules. They sought to direct the stream of enterprise into new channels, to force it onto unfamiliar highways. This made business confidence impossible because business men didn't know what was ahead, to what new conditions they might have to adapt themselves. Not knowing whether they would be expected to turn to the right or to the left, they hesitated while studying the new system of traffic lights, and of course things slowed down. About the only thing business can be sure of in the circumstances is that its taxes, to meet the mounting costs of government, will go right on accruing. Business can't use for development, expansion and wages the money it has to pay out in taxes; so it slows up, and finds itself wondering whether it is experiencing the symptoms of creeping paralysis.

"The business future, as I see it, depends largely on the attitude that legislators and public administrators shall take from this time forward toward business. We have had

"The end of 1937 will see gasoline inventories increased to levels considerably higher than sound economy dictates."—W. S. Farish.

Robert Yarnall Ritchie, courtesy Gulf Oil Corp.

too much of tinkering by theorizing Utopians and amateur economists, many of whom have been suspected of really wanting to destroy what exists, and then to try building something better out of the wreckage. They remind one of the country doctor who, whenever he confronted a serious case that he didn't understand, proceeded to throw the patient into fits and then treat the fits. Our economic doctors have succeeded in throwing the business patient into fits, and a change of treatment is badly needed. An invitation to business to get back on the trails by which in other times it has progressed toward higher living standards and greater security for the people would right now be the most reassuring thing that could happen."

WORLD DEMAND

Oil is a world commodity and the position in every exporting country is necessarily affected by the relationship between world supply and demand. This phase of the situation is dealt with in the following statement by James A. Moffett, chairman of California-Texas Oil Company:

"The oil industry is essentially one in which the forward picture as well as existing conditions must be kept constantly in view. The immediate situation is somewhat disturbed, due in the United States to the following conditions:

"(1) Excessive quotas of production granted in 1937 which permitted an increase of output in comparison with 1936 of 16 percent during the first ten months;

"(2) a slackening in general business momentum, and

"(3) the war clouds on the horizon.

"It is to be hoped that these are all temporary factors. Looking at the situation from the viewpoint of international production and consumption may give a better long range perspective.

"In the past five years a tremendous drive to find and produce oil has been made in countries outside the United States. In this period, since 1932, production in these countries has grown from approximately 520,000,000 bbl. to approximately 750,000,000 bbl. This is roundly 45 percent or 9 percent per annum. Production in the United States has grown from 785,000,000 bbl. to roughly 1,300,000,000 bbl., an increase of 65 percent or 13 percent yearly.

"Generally speaking, in this period, stocks have been reduced, indicating that consumption has exceeded the actual oil produced in the period. It is apparent in the international field that production is not keeping pace with consumption. To the extent that outside production does not keep pace with consumption it is obvious there will be an increased demand on the United States and a consequent increase in its export trade in petroleum. This has been strikingly in evidence during the year 1937. While Pacific Coast shipments to the Orient for military purposes have figured in this to some extent, there has been a natural increase in export shipments due to the failure of the outside production areas to meet the natural requirements. Russia, a few years ago a strong factor in export shipments, is no longer an important influence and the same may be said for Roumania. Had it not been possible to bring about a natural increase in Venezuela and Iran, the export requirements from the United States would have been greatly increased.

"Notwithstanding the world depression extending from 1932 to 1936, there was a natural, heavy increase in consumption and extending that percentage of increase through to 1940 without considering that a general improvement in world business has occurred and that general consumption is running at a heavier rate, it will be found that some 800,000 bbl. of new production must be made available to meet this increase. While the oil may be in the ground, it is difficult in such a short space of time to make it available for market and outside of Venezuela, Iran, Iraq and Colombia, there do not seem to be any areas where fairly prompt supplies can be secured. It is further estimated that the areas in question will fall short of supplying international requirements and the shortages, which may amount to several hundred thousand barrels, will fall upon American producers.

"If the same analysis is made as regards American production, it would appear that the United States may be required to produce in excess of 4,000,000 bbl. per day in order to meet the natural, normal requirements to which may be added the shortage existing in other areas.

"The thought has been expressed that maintaining a proper gas ratio, the American industry may have difficulty in maintaining a steady rate of production to meet the country's normal needs in addition to possible additional export requirements. There seems to be no diminution in armament programs and with increased battleships, heavy mechanized army equipment and the projected increase in aviation world wide, it would appear that there will be no decline in the rate of growth in consumption which has taken place during the past six years, but, rather, that an increase may properly be expected."

OIL INDUSTRY Out of Balance

By Frank Phillips

President, Phillips Petroleum Company

Only 50 Percent of Investment Now Earning Return—Self-Regulation, Officially Supervised, Needed to Protect Workers, Landowners and Stockholders—Revision of Federal Oil Policies Deemed Desirable.

IN 1937 sales of petroleum and its products reached a new all-time high. The demand was approximately 10 percent greater than last year and 25 percent higher than in the pre-depression year of 1929. Monthly wages are higher than at any time in the history of the industry and higher than in many other major industries. Profits for the year will be substantially above last year. This has been accomplished without burden to the consuming public. Refinery gasoline prices during 1937 were 22 percent below the average price in 1929.

Unlike other industries the oil business has not suffered serious reductions in sales during the depression years. Our chaotic conditions in the past have been due to overproduction of crude oil and gasoline and the destructive competitive practices within the industry, rather than to decline in consumption. With the sole exception of 1932 the gasoline consumption of the nation each year has exceeded that of the previous year. Unfortunately profits in the oil business do not always follow the trend of consumption. The profitable branches of the industry are production and pipelines. They represent 50 percent of the industry's

This article originally proposed as a year-end statement for World Petroleum, was made the basis of a radio broadcast delivered by the author at Tulsa, Oklahoma, December 31, before the Tulsa Chamber of Commerce.

investment and are subject to a certain amount of governmental regulation, while those that are losing money are not subject to governmental regulation.

The production division of the oil and gas business has reluctantly but surely surrendered its so-called "rugged individualism." It has abandoned its ruthless operation under the law of the jungle and has submitted to the law of supply and demand. This was accomplished by state conservation laws with the assistance of federal agencies, followed by the good influence of the Compact of States. There is much yet to be accomplished. We must have more uniformity of conservation laws of the various states and more rigid enforcement. Stocks of crude oil and gasoline, while not burdensome as yet, are increasing too rapidly. Production of crude oil must be limited to actual demand. Crude prices have held throughout the year but lower prices are inevitable unless the present rate of production is decreased. Proration has been so successful that it must be continued and extended until overproduction is eliminated.

There was a sharp break in refinery gasoline prices in the fourth quarter of 1937 and the refining and marketing branches of the industry are now operating at a loss. With gasoline consumption the highest in history, it seems unreasonable that this product should now be selling below cost. If this condition continues dividends, wages and employment, as well as service to the consuming public, will be seriously affected. During 1933 and 1934 the industry was in a deplorable condition. Oil was as low as 10 cents a barrel and gasoline two cents a gallon at the refinery. Wages were the lowest in history—thousands of people were out of work and the industry was losing money by the millions. The oil code at that time provided a remedy. Cooperation within the industry, with government sanction, made it possible to eliminate unfair competitive practices and prevented wasteful over-production of gasoline through the proration of refinery runs. Refineries cut back their runs in order to bring gasoline production more nearly in balance with current demand. Surplus stocks of gasoline were absorbed and the price improved. This constructive program which originated under the oil code has been abandoned. Today great confusion exists as to how the situation may be remedied in the face of the anti-trust laws, Robinson-Patman act, the Wagner act, and the many unreasonable and burdensome tax laws. In my judgment, action by the industry, in cooperation with state and federal agencies, is imperative. The buying public is protected against exorbitant prices that might result from unfair trade practices. We should have similar protection against ruinous prices and practices for the millions of workers, landowners and stockholders who are dependent upon the oil industry for all or part of their income. Just as conservation laws have enhanced our vast oil reserves and stabilized the production end of the business, so must laws be enacted, to stabilize refining and marketing. Otherwise, the crude oil price structure is in danger. Legal obstacles, of course, are in the way, just as they were when we faced demoralization by over-production, and oil was selling at ten cents a barrel. Those obstacles were overcome and the industry, under governmental policing worked out of a bad situation. I think we can, and I think we will, find a way to work out of the very unsatisfactory condition now existing with reference to refining and marketing. There is, I am sure, a solution, under constitutional guarantees, and I am confident that it will be found.

I am not an advocate of governmental control of the oil industry: I earnestly believe that the various anti-trust laws, the Robinson-Patman act, and other laws which have a strangle hold upon industry, should be so modified as to permit the industry to regulate itself. This regulation should have governmental sanction and should be supervised and policed by some governmental agency that will protect the public against monopoly and unfair trade practices; an agency with the power to enforce compliance with reasonable regulations adopted by the industry itself.

I have faith in our form of government, and I am confident that able men at the head of that government will find a way for government and business to cooperate on a rational, sensible basis—as friends, rather than as enemies.

At the end of each year for many years past, I have been asked to express my views as to what conditions will be during the coming year.

In view of present unsettled conditions, I believe our most astute economists are incapable of making a business forecast for 1938 with any degree of accuracy. We are undoubtedly in a new cycle of business and national affairs and what the future holds for industry depends, in my opinion, largely upon action at Washington.

Government, labor and capital hold equally important places in our economic scheme of life. One cannot function smoothly without the other two. Their relationship should be that of cooperation rather than antagonism. As we look over the past year we see a disappointing lack of cooperation. Business recovery cannot be accomplished as long as it is the policy of the administration to harass business, while at the same time demanding that it reduce

New uses for petroleum products are rapidly increasing consumption, but marketing is not profitable.

unemployment and increase wages. Confidence cannot be restored as long as the administration continues to break its promises to reduce expenses. It is impossible to legislate our way out of the depression with unsound laws. Labor cannot establish the security of permanent employment by destroying or discouraging capital.

I believe in high wage standards but these cannot be gained by government regulation and regimentation or labor ultimatums if they exceed the economic limits that industry is capable of paying. Capital's responsibility is to keep wages high by prudent management and efficient operations.

I believe that private industry could re-employ all willing workers if the government would cooperate with capital by eliminating present tax barriers, by abandoning all uneconomic pump priming projects and restoring public confidence by putting its own financial house in order. This country has always been the land of opportunity and will continue to be so if all selfish, highly organized political labor and business groups are curbed for the benefit of all. Therefore, I say that lasting prosperity and security will be achieved when government, capital and labor learn to cooperate, when class baiting is abolished and business antagonism by the administration ceases.

My confidence in the American people and their ability to govern themselves wisely and solve their economic problems' inspires me with optimism. Many changes are necessary for the good of all and I am confident they will be accomplished.

LISTED U. S. OIL SHARES Earn Estimated $2.80 Per Share in 1937

By Henry E. Rose

THE AMERICAN oil industry enters the new year confident that it will establish new records from the standpoint of production and sales volume. Its profits probably will be as satisfactory as in 1937. These, for the industry as a whole, were at the best level last year since 1929, and, in fact, came within a small margin of paralleling the boom year (1929).

In predicting that the current year's profits may be as large as in 1937, of necessity, it is presumed that the federal tax situation will not be altered materially with respect to the burden on large corporate incomes, and that labor will be tolerant in its demands.

The proposal of the federal government to establish minimum hours and wages for labor, if enacted, would exert virtually no adverse influence on the petroleum industry, since its wages are among the highest paid by any industry, and its hours of labor among the shortest.

From the standpoint of taxes, if there should be a downward revision of the levy on undistributed profits, thus permitting larger additions to surplus accounts than are now possible without penalty, the probability is that the oil companies will reflect this condition in somewhat smaller dividend payments to their stockholders. The very nature of the industry, demanding unremitting search for new oil reserves to replenish withdrawals, the necessity of keeping pace with improvements in the refining art and to provide for expansion, all require constant expenditures of capital.

Moreover, the forecast for the new year gives reflection to a generally lower gasoline price structure throughout the country, except on the Pacific coast, the adverse effect of which, in all probability, will be offset by larger volume.

While the general business situation will have its effect upon the oil industry, principally in demand for gasoline for trucks and fuel for plant operation, this volume, it is believed, will not cause serious inroads on profits.

Generally, sentiment throughout the oil industry is that this year's profits, considering the overall business picture, will be satisfactory. Anent the outlook for the domestic situation, it is well to record the views of Col. Leonard P. Ayres, of the Cleveland Trust Co., and one of the country's outstanding economists.

Col. Ayres stated recently that the "bottom of the present slump in industrial production will be reached in the first half of next year (1938), for operations have been curtailed so rapidly that in many lines we are already producing less than we are consuming. The recovery from the low is bound to be much slower than the descent to it has been."

He added, however, that the outcome will depend on "decisions that will be made in Washington and on policies that will be adopted there.

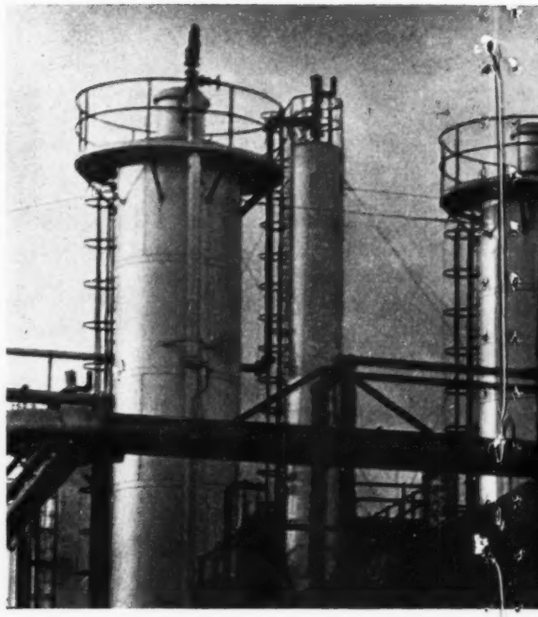
"We have all the economic requisites for prosperity. We have the men, money, materials and markets. Our difficulties are political, not economic. We need cooperation between government and business. If that can be attained we can have a resumption of recovery."

Of business that will show increased activity, Col. Ayres cites specifically the single one of petroleum refining, while he adds that little change is expected to be shown in electric power and tobacco products. The production of coal, iron, steel and cement are likely to be lower, he says, as are department store sales and carloadings.

As for the international situation, there are indications that the demand from abroad for American oil products will continue unabated. This is largely a reflection of increased world use; the building of stocks in certain European countries because of war fears, and the practical cessation of exports by Roumania and Russia. In total, the foreign demand for American crude oil and refined products attained a new high record in 1937. Shipments of crude oil in the first ten months surpassed the previous full year's record by some 4,000,000 bbl.

With record production and sales of petroleum products in 1937, the industry, as a whole, realized its best profits in eight years, or since 1929. For at least six companies, profits hit new high records.

Those companies engaged in the production of crude oil solely, and those integrated units with more crude production than their refinery needs, fared best, largely in reflection of higher and stable prices for crude oil throughout the year. Three major corporations in the latter group, as a matter of fact, struck up new peaks on profits.



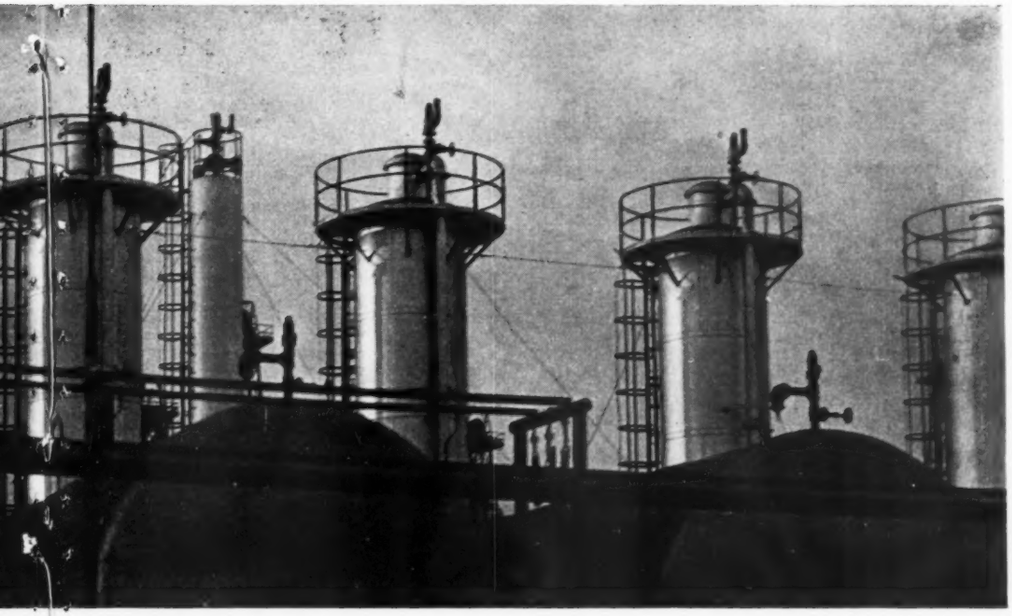
The statistical position, namely, production of crude oil and stocks, continues sound as the industry goes into the new year. There is but one phase, refinery operations and inventories of gasoline, the money product, which may prove somewhat topheavy between now and the end of March when, normally, gasoline stocks reach their peak prior to the advent of the heavy consuming season. But here, too, there is the expectation that inventories may be maintained within manageable bounds so that they may not exert a serious influence on price levels.

For 23 major American oil companies, whose shares are listed on leading stock exchanges, net profits in 1937 probably attained a total of $562,000,000, the equivalent of about $2.80 a share on the total number of common shares outstanding. This result, besides marking a gain of from 25 percent to 30 percent over 1936—$443,340,000, equal to about $2.40 a share—came within $27,000,000 of equalling what these identical companies earned in 1929—$589,607,660.

Had it not been for higher labor costs in 1937, when some major companies put into effect as many as two or three advances, last year's gain over the previous year would have been greater. Moreover, several companies made additional payments to employes at the year-end in the form of

bonuses in order to be relieved of the necessity of paying an undistributed profits tax.

Among companies which hit new high records in profits during 1937 are Continental Oil Co., Skelly Oil Co., Phillips Petroleum Co., all integrated units producing crude in excess of their refinery needs; The Texas Corp., Socony-Vacuum Oil Co., Inc. (since organization of the present company), and Tide Water Associated Oil Co., all producing about 50 percent of their crude refinery needs.



Creole Petroleum Co., the Venezuelan subsidiary of Standard Oil Co. (N. J.), also had a record year in 1937, a reflection both of larger production of crude oil and slightly higher prices. It realized net income equal to $1.23 a share in 1936.

As for Standard Oil Co. (N. J.), which publishes no interim reports, and whose income account is not available for at least five months after the year-end because of international affiliations, it is difficult to state at this time. In line with the industry as a whole, however, it is likely that its net profits will measure up to those for 1929, the peak year, when $120,912,794 was earned. The 1936 profits of Esso were equal to $3.73 a share of capital stock outstanding.

Estimates of per share net income of companies which set up new records last year are: Continental Oil Co. $3 against $2.05 earned in 1936; Skelly Oil Co. $6 against $4.42; Phillips Petroleum Co. $5.50 against $4.22; The Texas Corp. $5 against $4.10; Socony-Vacuum $1.90 against $1.38; Tide Water Associated Oil Co. $2 against $1.11.

For some other leading companies, estimates of net profits in 1937 range as follows: Amerada Corp. $2.85 versus $2.52 a share in 1936; Barnsdall Oil Co. $1.25 versus $1; Union Oil Co. of California $2.60 versus $1.40, and Standard Oil Co. of California $3 versus $1.78.

Some interesting comparisons are disclosed in first nine months' operations of those companies which report on an interim basis. Fourteen leading corporations reported net profits of $142,012,549 against $96,919,372 in 1936.

Five others, The Texas Corp., Socony-Vacuum Oil Co., Consolidated Oil Corp., Sun Oil Co. and Standard Oil Co. of Indiana, reporting for six months to June 30, showed total profits of $100,715,499, a gain of 47 percent over the $68,519,722 netted in the same half of 1936.

The most notable gains for the first nine months were scored by integrated companies producing almost sufficient crude to meet their own requirements and those with more crude production than needed in their refinery runs, as well as several solely producing companies.

Standard Oil Co. of California and Pure Oil Co., each producing almost its entire refinery needs of crude, came through with gains in the first nine months of 87 percent against the same period in 1936. Phillips, Skelly and Continental, all producing in excess of their refinery needs, registered increases of 54 percent, 52 percent and 43 percent, respectively. Plymouth Oil Co., a solely producing company, showed a gain of 67 percent, and Ohio Oil Co., with a minor refining and marketing business, increased 53 percent.

The largest gain was shown by Union Oil Co., operating on the Pacific coast, of 101 percent. It reflected, to some extent, an improved gasoline price structure in that area in the first quarter of 1937 as against 1936. The Texas Corp. and Socony-Vacuum Oil Co., which issued only semi-annual reports, showed gains of 70 percent and 60 percent respectively.

Several companies, reflecting the reduction in gasoline prices, came through the nine months with smaller gains—notably Shell Union, Atlantic Refining and Mid-Continent Petroleum Corp.

The effect of higher operating costs was reflected in successive quarters during the year, as were also lower gasoline prices in certain areas beginning at the close of the second quarter. Whereas profits of a group of companies in the first three months registered a gain of about 80 percent over the same three months in 1936, the following quarter revealed a paring down of the rate of gain, with a further reduction in the September period. For all of 1937, as stated above, the increase for the industry probably will range from 25 percent to 30 percent against 1936 results.

In line with larger profit showings, dividend payments by the leading companies in 1937 were at the highest level since 1930. For 23 American companies used in this tabulation, such payments aggregated $284,600,000 in 1937 against $218,850,000 in 1936, an increase of 30 percent.

The largest total payment was made by Standard Oil Co. (N. J.) of $65,560,000, equal to $2.50 a share, against $52,421,600, equal to $2 a share in 1936. Last year's dividend payments by Esso represented the largest outlay by the company since the dissolution in 1911.

Ranking in second place last year in dividend disbursements was Standard Oil Co. of Indiana, which paid out $34,915,000, equal to $2.30 a share, against $36,418,790 in 1936, equal to $2.40 a share. Standard Oil Co. of California distributed $26,030,000, at the rate of $2 a share, compared with $15,617,705, equal to $1.20 a share, a year ago. Socony-Vacuum paid out 80 cents a share, involving $24,920,800 against 70 cents a share, or $21,805,900, in 1936.

Other companies which disbursed $10,000,000, or more, in dividends last year included Consolidated Oil Co. whose payments were equal to 90 cents a share against 80 cents a share in 1936; Humble Oil & Refining Co. $2 against $1.50; Phillips Petroleum Co. $2.75 against $2.50; Shell Union Oil Corp. $1 against 25 cents; and The Texas Corp. $2.25 against $1.50.

Although several companies last year had plans to raise additional capital for further exploration, plant improvements and ex-

SIX YEAR FINANCIAL REVIEW—U. S. Oil Companies

	Net Income	Per Share of Com.	Net Working Capital	Net Capital Assets	Funded and/or Long Term Debt	No. of Pref. Shares	No. of Com. Shares	Surplus
Amerada Corp.								
(l) 1937	$1,673,878	$2.12	.....	.....	.....	.....	788,675	.....
1936	1,983,901	2.52	$4,183,364	$10,426,074	.....	.....	788,675	$4,232,943
1935	1,797,613	2.28	5,008,667	9,227,589	.....	.....	788,675	3,826,392
1934	1,736,420	2.20	5,096,673	8,966,293	.....	.....	788,675	3,606,139
1933	380,443	.50	4,942,424	8,576,743	.....	.....	767,375	3,424,559
1932	1,147,207	1.48	7,328,270	7,692,714	.....	.....	774,875	4,609,669
Atlantic Refining Co.								
(l) 1937	7,486,000	2.64	.....	.....	.....	148,000	2,664,000	.....
1936	7,342,197	2.59	34,627,900	113,737,073	522,793	148,000	2,664,000	64,841,504
1935	3,970,598	1.49	36,512,103	111,157,824	14,023,623	.....	2,664,901	65,617,388
1934	5,512,105	2.07	37,960,843	109,739,314	14,024,734	.....	2,664,902	66,791,823
1933	6,556,377	2.46	20,015,187	104,489,510	14,046,793	.....	2,665,234	64,202,597
1932	3,918,021	1.45	34,945,032	107,179,944	14,070,793	.....	2,696,642	61,144,504
Barnsdall Oil Co.								
(l) 1937	2,232,694	.99	.....	.....	.....	.....	2,247,974	.....
1936	2,262,544	1.00	4,611,623	10.044,519	5,000,000	.....	2,247,974	7,471,507
1935	741,136	.34	2,152,780	7,659,141	.....	.....	2,131,090	7,256,270
1934	(d) 1,029,447	...	3,719,365	14,968,355	318,510	.....	2,205,451	9,096,713
1933	(d) 1,942,635	...	3,760,360	15,522,433	.....	.....	2,258,779	10,695,191
1932	(d) 847,072	...	2,915,649	17,246,832	.....	.....	2,258,779	12,693,772
Consolidated Oil Corp.								
(n) 1937	9,434,917	.66	.....	.....	.....	.....	13,915,617	.....
1936	16,728,929	1.18	78,118,866	204,171,446	49,720,570	56,592	13,944,886	182,866,672
1935	11,306,904	.74	78,377,440	200,965,255	40,181,938	106,028	13,983,237	180,540,203
1934	553,282	(e) 5.43	75,099,378	208,402,801	47,343,015	101,844	13,996,172	175,399,041
1933	133,580	(e) 1.28	92,983,007	204,832,796	53,790,823	104,114	14,025,551	176,234,473
1932	(b) 1,601,039	.05	101,923,567	210,840,320	59,528,643	111,594	14,218,835	189,656,802
Continental Oil Corp.								
(l) 1937	11,614,575	2.48	31,559,660	49,284,219	.....	.....	4,682,586	67,796,807
1936	9,612,597	2.05	28,749,999	45,374,654	.....	.....	4,738,593	61,875,373
1935	8,813,561	1.88	31,154,643	39,825,881	.....	.....	4,682,664	56,880,127
1934	4,865,358	1.03	25,390,339	40,647,154	.....	.....	4,738,593	51,780,703
1933	2,275,860	.48	29,628,797	41,922,070	8,025,409	.....	4,738,593	48,549,652
1932	(d) 1,444,133	...	27,277,384	42,776,264	9,546,263	.....	4,738,593	45,504,505
Creole Petroleum Corp.								
1936	8,596,448	1.23	14,757,203	51,304,681	.....	.....	6,975,383	32,469,427
1935	5,509,067	.79	8,229,979	52,877,364	.....	.....	6,974,356	27,357,909
1934	5,315,254	.76	5,174,439	51,926,430	.....	.....	6,974,356	22,657,566
1933	4,106,099	.59	3,356,137	52,792,209	.....	.....	6,974,356	22,102,453
1932	2,075,403	.30	3,342,909	50,222,565	.....	.....	6,974,356	(d) 4,018,368
Gulf Oil Corp.								
1936	26,356,003	2.90	81,837,311	313,146,546	73,605,813	.....	9,076,202	102,756,263
1935	10,551,720	2.32	96,410,624	288,757,680	87,166,000	.....	4,538,101	199,049,566
1934	2,811,183	.62	97,615,006	283,076,187	91,629,847	.....	4,538,101	189,737,492
1933	(d) 11,386,387	...	90,174,574	276,725,868	102,462,863	.....	4,538,101	190,155,467
1932	2,743,492	.60	96,748,097	285,494,570	110,463,195	.....	4,538,101	195,567,278
Humble Oil & Refining Co.								
1936	34,183,527	3.80	26,962,743	226,310,687	266,945	.....	8,987,840	74,846,370
1935	23,966,326	2.66	29,002,746	204,138,789	487,610	.....	9,000,000	53,499,275
1934	21,989,954	2.45	31,580,204	193,059,994	6,831,050	.....	8,968,479	38,078,401
1933	20,847,817	2.32	46,952,934	179,020,501	18,950,000	.....	8,985,666	132,405,573
1932	14,896,613	1.65	45,123,591	167,504,927	18,950,000	.....	8,985,666	117,589,683
Imperial Oil, Ltd.								
1936	25,628,285	.95	71,088,190	43,028,222	.....	.....	26,965,078	81,133,214
1935	25,229,850	.94	72,607,155	53,572,421	.....	.....	26,965,078	89,211,976
1934	25,771,653	.96	69,055,219	58,520,697	.....	.....	26,919,871	97,678,704
1933	14,101,561	.52	49,243,315	65,053,656	.....	.....	26,857,152	110,645,191
1932	14,713,238	.55	49,310,547	69,883,456	.....	.....	26,783,092	109,958,799
Mid-Continent Petroleum Corp.								
(l) 1937	4,605,879	2.48	.....	.....	.....	.....	1,857,912	.....
1936	4,777,578	2.57	17,771,833	37,841,889	.....	.....	1,857,912	40,519,334
1935	2,417,175	1.31	17,132,369	36,662,598	.....	.....	1,857,912	38,311,091
1934	828,093	.45	15,133,343	36,947,518	.....	.....	1,843,872	36,893,649
1933	(d) 1,766,438	...	14,779,310	50,559,281	.....	.....	1,857,912	13,174,089
1932	(d) 2,081,900	...	14,034,087	53,942,030	.....	.....	1,857,912	14,971,218
Ohio Oil Co.								
(l) 1937	10,315,011	1.20	33,130,246	(k) 96,510,185	.....	548,077	6,563,377	23,050,522
1936	7,881,571	.70	32,053,658	(k) 98,929,683	.....	548,077	6,563,377	18,570,516
1935	5,488,267	.33	32,155,437	(k) 93,314,153	.....	548,077	6,563,377	17,915,323
1934	5,411,924	.32	33,740,981	(k) 95,599,183	.....	580,943	6,648,052	10,789,515
1933	(d) 133,016	...	32,438,578	99,028,129	.....	580,943	6,648,052	11,672,319
1932	7,242,981	.58	27,942,774	(k) 100,050,004	.....	580,796	6,648,052	17,565,680
Phillips Petroleum Co.								
(l) 1937	19,813,719	4.45	.....	.....	.....	.....	4,449,052	.....
1936	17,875,489	4.22	23,362,194	146,812,781	14,009,258	.....	4,449,052	29,153,170
1935	13,421,703	3.23	23,450,267	137,258,621	20,945,221	.....	4,152,836	21,954,036
1934	5,757,308	1.38	21,601,235	136,992,626	26,393,309	.....	4,153,235	13,721,113
1933	1,500,695	.36	19,652,248	141,510,522	29,983,963	.....	4,154,687	12,116,812
1932	775,766	.18	13,579,510	149,656,040	33,329,962	.....	4,153,104	10,616,117
Pure Oil Co.								
(l t) 1937	9,000,000	1.77	.....	.....	.....	442,203	3,982,021	.....
1936	7,658,372	1.63	22,195,113	115,413,650	35,194,361	359,617	3,285,120	41,385,155
1935	8,150,026	2.00	24,685,287	110,753,615	38,743,113	309,000	3,038,700	41,728,169
1934	(d) 884,872	...	12,175,503	108,456,105	28,500,000	300,270	3,038,700	34,768,621
1933	811,086	(g) 2.75	12,804,584	102,602,376	30,500,000	300,270	3,038,700	35,766,659
1932	642,386	(g) 2.14	12,866,311	104,397,973	32,500,000	300,270	3,038,700	35,075,043

	Net Income	Per Share of Com.	Net Working Capital	Net Capital Assets	Funded and/or Long Term Debt	No. of Pref. Shares	No. of Com. Shares	Surplus
Seaboard Oil Co.								
(l) 1937	$1,782,382	1.43	.....	.....	.....	.....	1,244,383	.....
1936	2,485,675	2.00	$1,726,067	$5,750,047	.....	.....	1,244,383	$3,084,451
1935	1,670,847	1.34	2,149,116	5,660,271	.....	.....	1,244,383	1,843,158
1934	1,375,590	1.10	2,323,826	5,523,004	.....	.....	1,244,383	1,416,694
1935	1,275,565	1.02	2,826,454	5,460,401	.....	.....	1,244,383	1,285,487
1932	858,172	.71	2,103,481	5,459,451	.....	.....	1,244,383	763,842
Shell Union Oil Corp.								
(l) 1937	15,984,218	1.11	.....	.....	.....	343,500	13,070,625	.....
1936	(s) 22,494,364	1.57	52,628,694	262,438,076	58,764,000	343,500	13,070,625	11,579,155
1935	6,812,835	.37	41,353,931	261,648,294	50,153,979	388,166	13,070,625	3,419,589
1934	(d) 949,111	...	39,068,934	260,050,464	53,581,227	400,000	13,070,625	(d) 18,435,042
1933	(d) 5,250,290	...	56,784,051	270,029,142	81,540,451	400,000	13,070,625	(d) 17,081,141
1932	(d) 4,288,496	...	59,651,206	285,784,252	96,190,376	400,000	13,070,625	(d) 12,840,176
Skelly Oil Co.								
(l) 1937	5,346,940	5.02	.....	.....	.....	66,300	1,008,549	.....
1936	4,850,314	4.42	5,476,993	38,014,854	44,224,830	66,300	1,008,549	11,647,109
1935	2,585,849	2.16	5,946,672	33,260,799	8,756,859	66,300	1,008,548	9,335,556
1934	713,577	.30	5,841,952	31,527,488	9,615,679	67,000	1,008,548	(d) 2,745,942
1933	(d) 1,107,661	...	7,956,075	29,563,306	9,814,000	74,800	1,008,548	(d) 3,795,193
1932	(d) 1,043,682	...	8,059,963	32,824,685	10,935,500	94,300	1,008,548	(d) 4,173,036
Socony-Vacuum Oil Co., Inc.								
(n t) 1937	32,000,000	1.01	.....	.....	.....	.....	31,708,452	.....
1936	42,909,362	1.38	166,291,713	424,296,564	68,372,972	.....	31,151,071	157,766,869
1935	22,525,892	.71	186,858,832	400,094,099	74,326,495	.....	31,708,456	146,736,060
1934	24,121,297	.76	184,148,471	400,204,514	85,014,584	.....	31,154,279	138,588,901
1933	22,545,462	.71	208,663,144	613,445,907	83,312,556	.....	30,905,006	55,866,705
1932	5,320,282	.17	238,259,829 (j)	672,149,125	88,687,021	.....	31,019,693	50,494,006
Standard Oil Co. of California								
(l) 1937	31,135,818	2.39	.....	.....	.....	.....	13,014,754	.....
1936	23,310,223	1.78	58,160,244	448,223,894	5,000,000	.....	13,014,754	217,070,827
1935	18,594,330	1.42	62,647,719	445,640,587	5,000,000	.....	13,102,900	212,453,308
1934	18,327,807	1.40	80,120,833	437,191,071	.....	.....	13,102,900	211,733,009
1933	7,560,903	.58	85,290,291	446,139,358	.....	.....	13,102,900	213,630,216
1932	13,994,992	1.07	80,711,983	458,666,507	.....	.....	13,102,900	223,272,323
Standard Oil Co. of Indiana								
(n) 1937	27,904,211	1.83	.....	.....	.....	.....	15,235,323	.....
1936	46,883,448	3.09	165,331,918	347,502,925	4,094,689	.....	15,196,241	265,367,464
1935	30,179,895	1.98	170,876,326	366,184,636	10,579,963	.....	15,215,677	253,905,946
1934	18,949,680	1.25	182,889,895	175,715,684	8,413,670	.....	15,215,677	226,267,121
1933	17,674,351	1.14	192,298,854	306,632,853	7,677,413	.....	15,528,504	228,047,576
1932	16,558,282	1.04	203,452,389	308,881,744	37,140,256	.....	15,941,894	227,415,764
Standard Oil Co. (N. J.)								
1936	97,774,583	3.73	432,337,756	1,042,421,175	84,573,564	.....	26,224,767	491,093,355
1935	62,863,192	2.43	425,337,478	1,054,520,041	82,772,730	.....	25,856,081	448,127,942
1934	45,618,960	1.76	407,165,346	1,082,380,163	141,461,816	.....	25,856,081	449,062,205
1933	25,084,310	.97	407,177,198	1,060,449,508	179,398,236	.....	25,761,465	507,846,292
1932	282,865	.01	447,151,246	1,148,830,800	207,245,001	.....	25,740,965	520,556,406
Standard Oil Co. of Ohio								
1936	4,194,314	4.76	12,764,256	34,730,917	602,026	120,000	753,740	17,112,466
1935	2,690,647	2.77	11,245,428	34,427,880	741,915	120,000	753,740	15,275,632
1934	(d) 1,913,735	...	8,670,081	35,771,654	266,800	120,000	753,740	13,184,984
1933	(d) 823,357	...	10,600,970	34,619,520	305,855	120,000	753,740	15,945,709
1932	(d) 1,206,361	...	10,382,424	38,571,056	326,035	120,000	753,740	17,691,344
Sun Oil Co.								
(n) 1937	4,376,371	1.71	21,246,891	72,067,692	9,476,150	100,000	2,156,825	13,045,800
1936	7,563,554	3.44	20,628,939	70,007,334	6,467,583	100,000	2,156,825	10,053,004
1935	7,100,239	3.45	20,043,466	62,787,994	6,675,681	100,000	2,030,988	9,512,101
1934	6,650,464	3.51	16,250,464	62,545,483	6,500,000	100,000	1,893,982	9,609,319
1933	6,971,844	4.04	18,134,634	60,640,679	10,541,000	100,000	1,576,697	10,778,750
1932	4,198,046	2.35	17,243,193	60,440,669	11,864,000	100,000	1,531,422	10,999,863
Texas Corp.								
(n t) 1937	27,000,000	2.48	.....	.....	.....	.....	10,896,858	.....
1936	38,260,341	4.10	93,179,802	295,631,713	88,819,129	.....	9,336,739	135,946,875
1935	17,065,037	1.83	125,756,164	257,074,288	93,253,676	.....	9,340,069	103,074,635
1934	5,545,205	.59	119,372,463	266,660,893	103,600,076	.....	9,349,733	103,232,978
1933	(d) 491,004	...	126,073,698	266,020,236	104,092,777	.....	10,352,371	111,612,512
1932	(d) 2,161,841	...	133,426,320	186,637,122	109,804,745	.....	10,486,368	134,352,282
Tide Water Associated Oil Co.								
(l) 1937	12,171,435	1.61	.....	.....	.....	500,000	6,343,468	.....
1936	10,217,928	1.11	31,990,255	120,062,336	15,925,172	626,221	6,288,512	25,634,444
1935	7,865,701	.73	33,682,501	117,806,258	19,774,335	626,221	5,642,342	21,336,760
1934	5,810,657	.35	41,220,500	113,226,094	2,504,892	636,222	5,631,341	20,620,669
1933	7,265,301	.61	43,241,327	114,383,792	9,280,790	643,023	5,618,672	20,967,673
1932	4,718,693	.13	37,765,931	119,982,364	13,218,754	666,524	5,611,040	13,694,604
Union Oil Co. of California								
(l) 1937	8,850,000	1.90	43,700,000	.....	.....	.....	4,386,070	.....
1936	6,133,398	1.40	36,147,816	107,856,361	20,326,500	.....	4,386,070	15,868,299
1935	5,038,286	1.15	35,545,741	108,543,534	21,526,500	.....	4,386,070	14,120,970
1934	2,902,733	.66	35,976,560	107,956,010	21,489,500	.....	4,386,070	13,914,222
1933	1,954,279	.45	42,640,151	139,738,680	26,687,000	.....	4,386,070	47,060,129
1932	3,211,084	.73	45,739,877	144,881,088	31,609,145	.....	4,386,070	50,673,657

(b) Eleven months ended December 31, 1932.
(c) As of January 1, 1932.
(d) Deficit.
(e) On preferred stock.
(g) On $100 par combined 5½, 6 and 8% preferred stocks.
(j) Including good will, appreciation of properties, etc.
(k) Exclusive of good will, patents, etc.
(l) Nine months ended September 30.
(n) Six months ended June 30.
(s) Including profit of $2,909,087 from investment sale.
(t) Official Estimate.

pansion, as well as for other corporate purposes, they were prevented from putting their plans into effect because of unsatisfactory securities markets which developed in mid-summer and continued throughout the remainder of the year.

A few, however, sold notes privately to insurance companies at low rates of interest. Phillips Petroleum Co., one of these, sold an issue of $21,000,000 serial notes maturing finally in 1945, and bearing interest from 3 percent to 3½ percent. The financing represented virtually a merger of a former debt—$12,000,000—with the same insurance company, and resulted actually in an increase of $9,000,000 in Phillips' long-term debt.

The financing was in lieu of a previous proposal to offer 444,905 additional shares of capital stock to shareholders in the fall. Because of adverse security markets, however, this plan was abandoned and is not likely to be revived unless there is a marked improvement in the capital market.

Socony-Vacuum Oil Co., early in the year, sold $75,000,000 of 3½ percent 18-year debentures to a group of five insurance companies, the details of which were published in earlier issues of WORLD PETROLEUM.

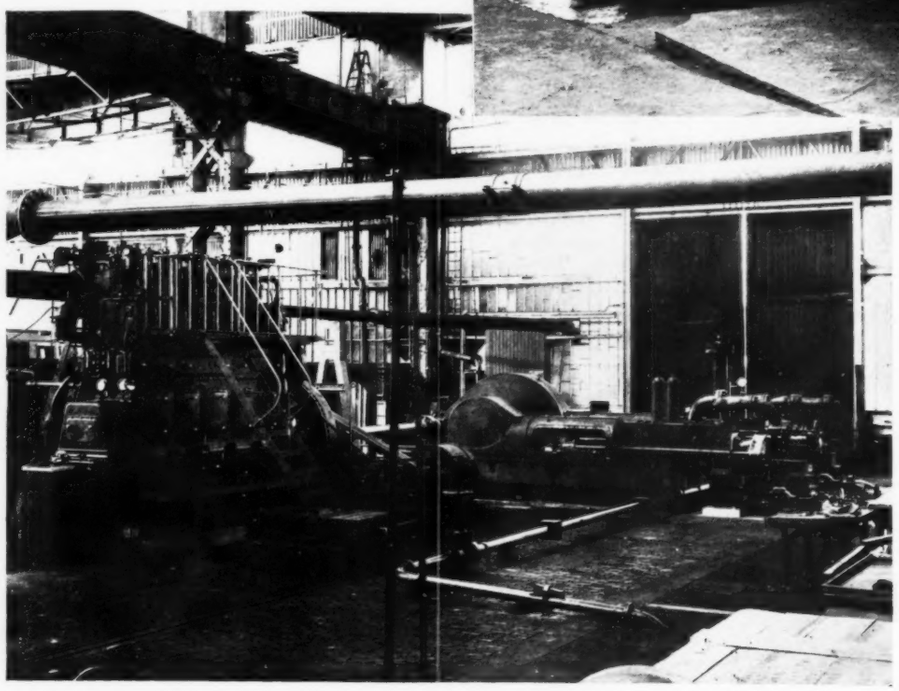
Colombian Petroleum Co., the Colombian company owned jointly by Socony-Vacuum Oil Co. and The Texas Corp., sold $15,000,000 of debentures to an insurance company last fall to finance development work.

Earlier financing projects by leading companies, the details of which were published in this magazine on previous occasions, included the sale of an additional 1,557,000 shares of capital stock by The Texas Corp.; $40,000,000 of 3½ percent 15-year debentures and 500,000 shares of $4.50 cumulative preferred stock by Tide Water Associated Oil Co., part of the proceeds to be used to retire a higher rate preferred issue outstanding; and $44,240,300 of new 5 percent cumulative preferred stock by Pure Oil Co., partly to retire higher rate preferred.

If a favorable trend develops in securities markets this year, it is probable that new financing will be undertaken by other companies. The funds so obtained will be used largely in the development of new oil reserves and additions to refineries.

An important development for American companies in the foreign field during the past year comprised the closing of an agreement between affiliates of Standard Oil Co. (N. J.) and Gulf Oil Corp. affecting the latter's crude production in Venezuela. Mene Grande Oil Co., C. A., subsidiary of Gulf, has contracted to sell its surplus production, at present approximating 40,000 bbl. daily, to International Petroleum Co., Ltd., a subsidiary of Imperial Oil, Ltd., which is controlled by Esso. The contract runs for a long term of years and an advance payment of $25,000,000 has been made by the purchasers in anticipation of future deliveries.

From a financial viewpoint, the transaction will prove beneficial to both companies. it gives Mene Grande an outlet for its excess output and enables International Petroleum to realize a profitable return on a substantial part of its net current assets (cash and marketable securities) which, at present, are yielding at best only a fractional percentage interest.



The oil industry is an important purchaser of all types of heavy equipment, demanding the largest hollow forgings, rotary equipmant and Diesel engines.

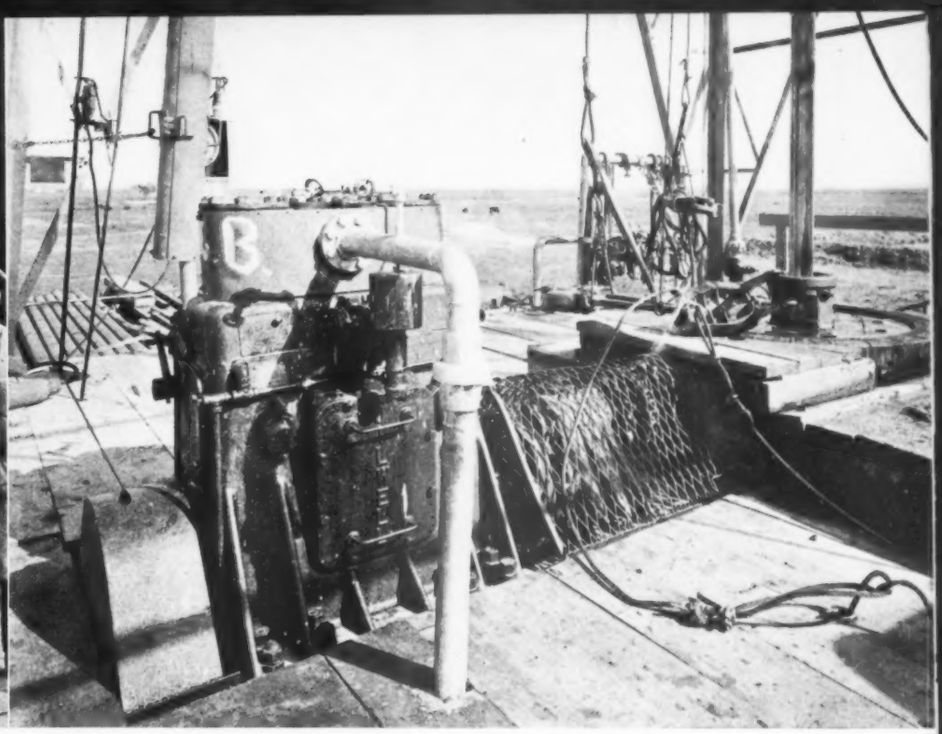
REPRESENTATIVE
Equipment Concerns

SHARING in the prosperity of the oil and gas industry, the principal equipment companies, whose shares are traded in on leading securities markets, came through last year with profits at the best levels in years. Several established new high records.

Since their fortunes are tied in closely with activity in the oil industry, their outlook, particularly for those engaged in the manufacture and sale of supplies for drilling, pipeline activities and refinery equipment, is for a continued high level of operations, at least for the first half of 1938. Some, as a matter of fact, have a substantial backlog of unfilled orders which is being carried into the new year and assures a high rate of production for some time.

Sales of American equipment abroad, especially of drilling apparatus and refinery equipment last year, because of superior quality, were materially above the levels of 1936, and for some items, were at the highest rate in many years.

Like the oil companies, the suppliers of material were faced with higher operating costs in 1937. Their fate in 1938, from the standpoint of profits, will depend in large measure on such costs. Tax legislation, an



THREE-YEAR REVIEW—Oil Equipment Companies

Nat. Supply Co.	Gross Income	Net Income	A Share on Common	Net Current Assets	Net Capital Assets	Funded and/or Long Term Debt	Preferred Shares	Common Shares	Surplus
*1937	$15,310,179	$6,614,289	$5.00	$34,276,186	$28,972,682	$6,294,000	166,353	1,148,364	17,165,493
1936	12,943,002	3,483,602	6.06	29,589,130	28,414,695	6,294,000	166,353	382,788	13,841,274
1935	8,467,228	670,620	(a)	26,887,475	25,320,702	6,294,000	166,221	382,656	9,681,274
1934	7,199,744 (d)	121,486	...	27,458,270	24,724,518	7,000,000	166,215	382,650	8,912,981
Bridgeport Machine Co.									
(n) 1937	+6,120,971	510,110	1.86	3,015,912	412,190	650,000	4,993	260,000	1,241,458
1936	+4,280,760	361,651	1.26	2,089,121	338,315	.....	4,993	260,000	830,837
1935	+2,538,490	139,871	.70	1,059,117	394,411	62,400	5,019	150,000	779,654
1934	+1,899,614	221,907	1.25	1,095,925	301,704	111,900	5,019	149,710	688,413
Byron Jackson Co.									
*1937	.....	1,062,607	2.81	2,192,874	.....	.....	.....	378,680	.....
1936	(c) 1,483,874 (b)	1,100,000	3.01	1,614,937	1,210,725	288,000	.....	373,926	894,838
1935	(c) 1,026,341	456,142	1.31	1,178,925	1,239,090	941,000	.....	347,480	617,387
1934	(c) 735,549	317,391	.92	1,811,834	1,269,439	1,758,000	.....	346,356	473,378
Reed Roller Bit Co.									
*1937	.....	1,808,266	2.87	.....	.....	.....	.....	630,000	.....
1936	.....	1,480,709	2.35	2,067,193	3,555,417	.....	.....	630,000	5,757,670
1935	(g) 1,899,283	695,746	3.52	1,796,308	3,238,545	.....	.....	197,750	(h) 5,054,720
1934	(g) 1,725,414	651,264	3.29	1,623,337	3,641,180	.....	.....	197,750	(h) 5,272,636
Emsco Derrick & Equipment Co.									
1936	(j) 5,682,492	656,246	1.76	2,520,724	1,370,241	.....	.....	373,594	2,378,222
1935	(j) 4,178,703	571,306	1.53	2,377,021	1,227,460	.....	.....	373,594	2,108,113
1934	(i) (j) 3,335,000	444,164	1.19	2,261,032	1,044,797	.....	.....	373,594	1,957,101
Tokheim Oil Tank & Pump Co.									
*1937	(j) 4,832,180	548,458	2.79	1,575,290	.....	85,000	.....	196,420	1,462,791
1936	(j) 4,335,138	388,123	2.26	896,456	744,987	.....	.....	(m) 171,520	1,325,575
1935	(j) 2,760,873	162,430	.95	.....	.....	.....	.....	(m) 171,520	1,232,407
1934	(j) 1,168,900 (d)	128,768	...	.....	.....	.....	.....	.....	1,074,148
Houston Oil Field Material Co.									
*1937	6,913,610	462,259	2.36	.....	.....	.....	25,000	184,340	.....
1936	5,185,872	282,871	19.67	464,271	172,988	.....	.....	14,232	292,086
1935	3,463,728	82,144	...	.....	.....	.....	.....	.....	.....
1934	2,425,959	68,863	...	.....	.....	.....	.....	.....	.....
Parkersburg Rig & Reel Co.									
(k) 1937	.....	525,958	2.51	2,365,853	1,517,812	.....	25,000	182,000	1,788,542
1936	4,636,696	615,960	2.66	1,963,135	1,512,864	.....	25,000	180,000	1,376,756
1935	3,428,838	275,596	.77	.....	.....	.....	25,000	180,000	1,126,796
1934	2,686,485	113,226	...	.....	.....	.....	.....	.....	911,240
Wayne Pump Co.									
*1937	7,014,001	1,385,347	4.78	.....	.....	.....	.....	289,659	.....
(e) 1936	7,679,398	1,325,279	4.58	2,866,648	1,314,994	.....	.....	289,659	3,599,040
(e) 1935	.....	496,526	2.38	2,239,184	1,241,003	.....	.....	208,459	1,682,727

(*) Nine months ended September 30.
(+) Net sales and rentals.
(a) Equal to $4.03 a share on preferred stock.
(b) Includes non-recurring profits of $322,388 from sale of an affiliate.
(c) Gross profit on sales.
(d) Deficit.
(e) Before federal taxes.
(f) As of June 30, 1936.
(g) Gross operating income.
(h) Capital stock and surplus as reported in those years.
(i) Approximate.
(j) Net sales.
(k) Six months ended June 30.
(l) Year ended November 30.
(m) Giving effect to capital change in February, 1937.
(n) For ten months ended October 30.

Photo by Morris Rosenfeld

Rubber, wire-rope, tubing and valve companies all sell an appreciable proportion of their factory output to petroleum companies.

unknown quantity at this time, also will be a major factor to the reckoned with in any forecast for the new year.

Concurrently with betterment in their operating status, these companies paid out to their junior stockholders more in dividends in the aggregate than in 1936, and, in fact, the largest amount in several years. At least two paid dividends last year whereas no payments were made in 1936. These were Wayne Pump Co., which distributed a total of $3.50 a share, and National Supply Co., which paid a dividend on common at the rate of 1/10 share of new $2 prior preferred stock.

Bridgeport Machine Co., which resumed dividends on common stock late in 1936 by the payment of $1 in cash, established a regular $1 annual rate in 1937, and distributed, in addition, the equivalent of $1 a share payable in 7 percent cumulative preferred stock.

Byron Jackson Co. paid out the equivalent of $2.50 a share in 1937 against $2.45 in 1936; Parkersburg Rig & Reel Co. $2 in cash against $1.90 cash and a dividend in preferred stock; Reed Roller Bit Co. $2 against $2.30; Emsco Derrick & Equipment Co. $1 against $1.12½ and Tokheim Oil Tank & Pump Co. $2 a share on 196,420 shares against $50 on 4,288 shares outstanding in 1936.

Profits of these companies last year, as stated, showed marked improvement over 1936. The most conspicuous gains were registered by those units engaged in the manufacture of drilling equipment.

National Supply Co., in the first nine months of 1936, reported net profits of $6,614,289, which was 130 percent higher than in the corresponding period of 1936, and about 92 percent greater than for 1936.

During the year, in May, it split its common stock (382,656 shares of $25 par) on a three-for-one basis, and reduced par value to $10 a share, making a transfer from capital surplus equal to $5 a share to effect that split-up. Subsequent to this rearrangement of common stock, the stockholders, in October, authorized a merger of the company with Spang Chalfant & Co., Inc., into a new company to be known as the National Supply Co. of Pennsylvania.

In conjunction with that merger, a capital reorganization was undertaken which provided, among other things, for the issuance of new preferred stock to former National Supply preferred holders to clear dividend arrearage on the latter, and to pave the way for a resumption of dividends on common stock.

National Supply's authorized capital stock, in consequence of the merger, consisted of 300,000 shares of 5½ percent prior preferred stock of $100 par, convertible for 10 years into common stock, or, for a period of 30 days into prior preferred stock 6 percent series; 300,000 shares of 6 percent prior preferred stock, $100 par, to take care of the exchange of all shares of prior preferred 5½ percent series; 600,000 shares of $2 ten-year preference stock, $40 par, convertible into common stock, and 2,500,000 shares of $10 par common stock.

Previously, National's authorized capital consisted of 200,000 shares of 7 percent cumulative preferred stock, on the outstanding shares of which (166,353) there was an accumulation of $35 a share, and 1,500,000 shares of $10 par common stock, of which 1,148,364 are currently outstanding.

Bridgeport Machine Co.'s profits in the first nine months of last year scored a gain of 66 percent over those in the similar period of 1936, and ran about 60 percent ahead of net income for all of 1936. On present indications, it is likely that for all of last year (1937) the company will earn the equivalent of about $2.15 a share on common stock.

Others in the equipment group whose net profits in the first nine months ran in excess of those for the full year 1936, included Reed Roller Bit Co., Emsco Derrick & Equipment Co., Tokheim Tank & Pump Co., Houston Oil Field Material Co. and Wayne Pump Co.

Estimates of earnings for some of these companies for all of 1937 include about $4 a share for Parkersburg, a new record, against $2.60 netted in 1936; from $2.50 to $3 a share for Houston Oil Field Material Co. against $2.36 and about $5.20 a share for Wayne Pump Co. against $4.58.

In the accompanying tabulation is shown the three-year record of these nine companies (for several all data are not available) and for the interim periods in 1937.

BRITISH Oil Companies Have a Good Year

Ay Alec Day

COMPLETE transformation has taken place in the market position of British oil shares during 1937. Towards the close of 1936 the market had received several disappointing dividend announcements, but had such strong faith in the future that discouragements of this kind passed unnoticed.

December 1937 found the position exactly reversed. Several dividend and profit statements have greatly exceeded market hopes, but share values have failed to respond. As a consequence, oil shares closed the past year offering the investing public high investment returns on the basis of dividends declared during the year.

The change in the position can be seen from the accompanying table, setting out prices at the beginning and the end of 1937, distributions for the last complete year and yields on the basis of those distributions. Average yield on the six representative shares included in the table increased from 3.7 percent at the end of 1936 to 6.0 percent on December 15 last.

Taken at its face value, the big advance during the year in the rate of yield offered by sound oil shares would imply a drastic change in the outlook for the industry. Since no such change has taken place, reasons for the high returns offered on the shares must be sought in other directions.

One explanation is provided by the fact that at the end of 1936 oil dividends had not reflected the full recovery in the oil industry, while stock exchange prices for the shares had already been raised substantially in expectation of better dividends to come. The distributions taken as the basis for the 1936 table were therefore relatively low and share prices high, with the result that the yields were small.

This position has now been reversed to the extent that expectations have been realised, at least in part, and the distributions on which the 1937 yields are based are well above those of the preceding year.

Nevertheless, even a straight comparison of prices in the table shows that, with few exceptions, quotations on December 15, 1937, were substantially below those ruling at the beginning of the year. This must be attributed mainly to the general decline in security prices on the London stock exchange, due to factors unconnected with the oil industry. When markets generally are flat the natural tendency is for all sections to be affected. Prospects for individual companies or industries, however favourable, do not prevent a decline in the shares concerned. This is apparently what has happened to oil share prices during the latter part of 1937. By declining to figures which offer highly attractive returns on current dividends, they have merely conformed to the general movement of security values.

Lower share prices are certainly not a reflection of deterioration in the outlook for oil dividends, for the year 1937 has every appearance of having been decidedly better than 1936. Improvement in the dividend announcements recently published and statements at annual meetings of oil companies, both provide evidence to this effect. In the great majority of cases, oil chairmen, reviewing 1937 operations to date, have indicated that conditions have been quite as satisfactory as in 1936. Consideration of all the factors operating suggests that for most British oil companies they have been decidedly better.

This applies particularly to the British market, where consumption, prices and profit margins have all been favourable to sellers. Retail prices for motor spirit, although failing to hold the high level of 1s. 7½d. ruling from April until July, have stood at more profitable figures than in the previous year. The average selling price for first grade spirit during 1937 was just over 1s. 7d. per gallon, compared with 1s. 6d. for 1936. Other grades have improved proportionately, and higher retail prices have had a favourable influence on the level at which sales of motor spirit by contract have been transacted.

For the more important distributors in the British market, producing in their own oilfields or those of associated concerns, and conducting their own transport, higher selling prices mean larger profit margins, whatever may be the course of export prices and tanker freights. Undertakings of this type must have found the past year a highly satisfactory one, even allowing for the heavy tax of 8d. per gallon on motor spirit and for the cost of the highly efficient service given by oil distributors.

Quotations for other main petroleum products, like motor spirit, have attained higher average prices in 1937 than in the preceding year, so that profit margins should have shown an allround increase.

Business has also expanded in volume. Releases of all products for the first nine months of 1937 totalled 46,150,318 bbl. compared with 43,681,637 bbl. in the corresponding period of 1936, the advance being equal to 5.7 percent. Thus, increased turnover, as well as larger margins, has contributed to the earnings of the past year, which must have been the best in Britain for a long period.

In view of the increased profitability of markets, not only in Britain but in other countries, the outlook for company profits for 1937 can be considered highly encouraging. In framing dividend policy, oil directors will probably be inclined to look further ahead, but as far as Great Britain is concerned, the further outlook is also favourable.

Official announcements have made it plain that the government re-armament program will continue to stimulate industry for several years to come. This in itself will not only be directly responsible for the absorption of large quantities of petroleum, but will also tend to maintain the general level of business activity, and thus give indirect support to sales of motor spirit and other products.

Yield of British Oil Shares

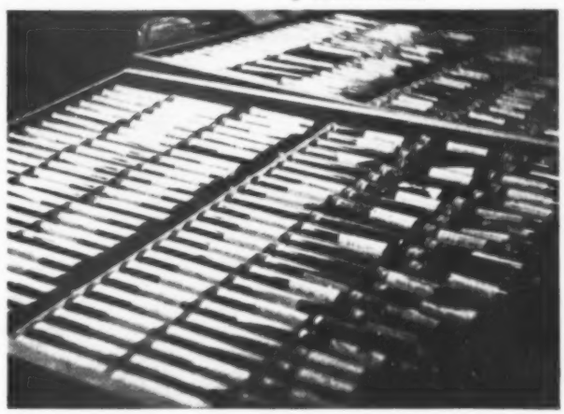
£1 shares or units	January 1 1937 Price	Dividend	Yield	December 15 1937 Price	Dividend‡	Yield
	£	%	%	£	%	%
Anglo-Ecuadorian	1 ⅛	10	5.6	1 ⅛	15	8.3
Anglo-Iranian	5 ⅞	15	3.0	4	25	6.2
Burmah	5 ⅛	20	3.7	5 ⅛	27½	4.7
Lobitos	2 ¼	7½	3.3	2	12½	6.2
Shell Transport	6½	17½†	2.7†	4 ⅛*	20†	4.2†
Trinidad Leaseholds	6 ⅞	25	4.0	5 ⅛	30	5.9

‡Including cash bonus if any.
*Share bonus declared during year
†Tax free

Prospects for companies selling in Britain during 1938 are therefore definitely favourable. British oil companies operating elsewhere will be more affected by world economic conditions, exchange considerations, and the level of oil prices in the United States. The American position, too, will doubtedless have its effect on the oil price level in Britain itself, and for this reason the balance between American production and consumption of crude and the major products is being watched closely here for indications as to what may be expected during the coming year.

Cores taken during the drilling by Anglo-Iranian of a test well.

© Gaumont-British



ROUMANIA To Export Less Crude, More Refined Products

By Mihail Pizanty

UNTIL 1936 Roumania held fourth place among oil producing countries of the world producing 3.7 percent of the world's crude supply. Due to the considerable increase of production in the United States, as well as to the decline of output of Roumanian wells, its importance dropped to fifth place and lately to sixth, being responsible for only 2.71 percent of world production.

Roumanian Oil Industry, 1936 and 1937

	1936 (12 months)	1937 (6 months)
Crude oil production	8,704,000 tons	3,650,037 tons
Crude oil refined	8,043,000 "	3,417,987 "
Total exports	6,884,716 "	2,872,867 "
Exports through Constantza	5,596,568 "	2,425,005 "
Internal consumption	1,545,603 "	749,259 "

Although drilling efforts during the first eight months of 1937 were considerable (272,000 meters in eight months, as against 329,000 meters in 12 months in 1936), production recorded a decrease of approximately 16 percent.

From the point of view of refining, Roumania has made noteworthy progress. The total capacity of the 50 refineries in operation at present is estimated at over 11,000,000 metric tons of crude oil a year.

The oldest refinery dates back to 1840 and was put up in Lucacesti (Bacau) by N. Choss for the rudimentary separation by heat of greases from volatile products, for the use of local households.

It is worthy of note that Roumania marketed its crude oil production a long time before the establishment of refineries. Official documents show that exports of crude oil packed in barrels were made in 1825, 1832, 1840, to Turkey, Russia and Poland. The extraction of crude oil at that time was accomplished by rudimentary methods from dangerous hand-wells dug by skilful artisans to nearly 300 meters.

Refineries with the highest processing capacity belong to Astra Romana company (2,160,000 tons yearly) and Steaua Romana (1,580,000 tons yearly).

The above refineries aggregate 89 percent of the total processing capacity and have processed during the first six months of 1937 65 percent of the total quantity of crude oil which went into refineries. Roumanian refineries have utilized in 1936 a proportion of 68.2 percent of their processing capacity.

Only five refineries possess cracking installations as indicated in the accompanying table.

The gasoline obtained by cracking totaled 312,535 tons (16.3 percent of the total gasoline produced by distillation in 1936); the increase of cracked gasoline in 1936 over 1935 is of 17.5 per cent. The cracked gasoline represents 27.9 percent of the total raw material. In view of the good marketing results obtained in 1937 with gasolines, several refiners are now building cracking units. Thus Petrol Block has a unit in course of construction while Unirea and Dacia-Romano are negotiating this matter.

By degasolination of well-gases a quantity of 265,304 tons of gasoline was brought to refineries, while by the recovery of gasoline from manufacturing processes, a further quantity of 28,177 tons of gasoline was obtained.

Roumanian Refinery Throughout

Stocks on January 1, 1936	121,816 Tons
Entries in 1936	8,396,123 "
Total	8,517,939 "
Effectively processed	8,043,000 Tons
Shipments from refineries	349,672 "
Stocks on December 31, 1936	125,267 "
Total	8,517,939 "

If the quantity of fuel oil subjected to cracking were tripled (at present approximately 1,000,000 tons a year) a surplus production of gasoline amounting to 400,000 tons would be obtained, for the production of which otherwise 1,500,000 tons of crude oil would have to be used, which by cracking may be saved.

In this case (integral cracking of fuel oil) the percentage of gasolines obtained by different means would be 60 percent from distillation, 30 percent from cracking, 9 percent from natural gasoline and one percent polymer gasoline.

In the United States the ratio of various gasolines obtained by different methods is:

46 percent by cracking
45 percent by crude oil distillation
9 percent by degasolination of gases.

Lately special attention has been given to the production of high octane number gasoline. By polymerizing the gases resulting from cracking operations as well as by other methods, higher yields of this product are made available to supply the aviation demand and to supply material considered necessary for national defense, such as toluene and ethylene.

Present Sources of Roumanian Gasoline

Source	Tons	Percent
Gasoline from distillation	1,315,835	68.5
Gasoline from cracking	312,535	16.3
Natural gasoline	265,304	13.8
Polymer gasoline	28,177	1.4
Total	1,921,851	100.0

Roumania has important reserves of hydrocarbon gases (over 2,800,000,000 cubic meters per annum) which can furnish a huge amount of energy (equal to 2,800,000 tons of fuel oil).

The cities of Ploesti and Campina are supplied with gas from oil wells. These gases have a calorific power of approximately 10,000 calories per cubic meter.

The marketing of casing head gases is closely connected with the refining industry inasmuch as the gasoline obtained therefrom cannot be sold as such because of its high volatility and is therefore used in refineries as blends for the improvement of the quality of straight-run gasolines.

Average Yield in 1936

Gasoline	24%
Kerosene	16%
Gasoil	16%
Fueloil	34%
Other products	3%
Refinery fuel and loss	7%

In Roumania approximately 82 percent of the impounded gases are subjected to degasolination, a quantity of 265,000 tons of gasoline of 0.680 specific gravity being obtained therefrom.

Refiners in Roumania have been making substantial investments establishing plants capable of producing higher octane motor fuels. It is hoped that this will reduce the necessity for gasoline imports. By adopting the best processing methods, it is aimed at a production of oils in which the asphaltic base may be entirely eliminated, the use of domestic oils being assured under equal conditions with a similar yield.

Roumanian Refineries by Districts

Districts	Crude Oil Production 1000 Tons	Percent	Crude Oil run to stills 1000 Tons	Percent	Percentage of Capacity	Yearly Refining Capacity 1000 Tons	Percent
Prahova	3,600	50.0	6,520	97.3	63.3	10,300	89.6
Dambovitza	3,510	48.8	30	.5	12.0	250	2.2
Bacau	45	.6	25	.4	20.8	120	1.0
Buzau	45	.6				180	1.6
Others			125	1.8	15.0	650	5.6
	7,200	100.0	6,700	100.0	58.3	11,500	100.0

Paraffin is produced by four refineries of which "Steaua Romana" is the most important with a total annual capacity of 8,000 tons out of a total of 13,000 tons.

By districts, the estimated situation for 1937 regarding the crude oil production and the quantity processed in comparison with the total processing capacity, is as follows:

The refineries are located in the central oil regions at Ploesti, Campina, Brazi, Targoviste, Buzau, Bacau, etc. The ones located outside the cities supply local requirements.

The crude oil undergoing processing during 1936 was 72.9 percent paraffinous and 27.1 percent non-paraffinous.

Roumanian Refineries by Types

Operations	Number of Refineries in Operation	Yearly Capacity in 1000 Tons
Continuous distillation	15	6,000
Non-continuous distillation	35	850
Continuous Pipe Still distillation	15	4,900
Kerosene refining	50	2,682
Rectification of crude gasoline	31	885
Cracking	5	1,348
Re-distillation	9	527
Mineral Oils	19	1,000
Asphalt	13	170
Coke & briquettes	2	18
Paraffin	4	13
Gasoline recovery	3	37

Good quality asphalt is produced from Roumanian crudes as well as coke from cracking operations which is extensively used as fuel and in metallurgical plants in the production of iron and steel of superior quality.

The personnel employed in refineries totals 8,300 divided according to functions into technical staff of 2,620, managerial staff of 680 and 5,000 unskilled laborers.

Investment in the oil industry amounts to 25,000,000,000 lei approximately one half in refineries, connecting pipelines and transportation facilities from refineries to export or consumption centers.

Principal Roumanian Refineries

Company	Ownership	Annual Capacity (Tons)
Astra Romana	Royal Dutch Shell	2,160,000
Steaua Romana	British-French-Roumanian	1,580,000
Concordia	French-Belgian-Roumanian	1,340,000
Romano-Americana	Standard Oil Co. of N.J.	1,300,000
Unirea	Phoenix Oil & Transport Co.	1,191,000
Petrol Block	Roumanian and French	654,000
Creditul Minier	Roumanian	630,000
Colombia	French	525,000
Redeventa	Roumanian	502,000
Prahova	Italian	430,000
Dacia-Romano Petroleum Syndicate	British	217,000

One of the modern refineries recently completed is that of the Roumanian Creditul Minier company. The capacity of this refinery is 1,200 metric tons a day.

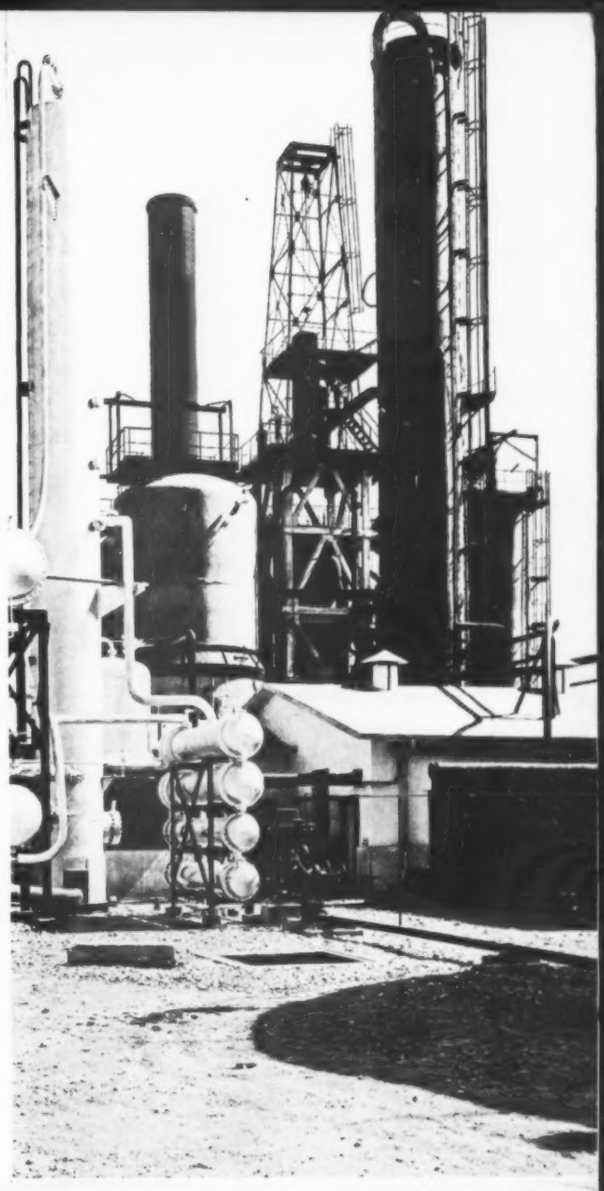
Astra Romana company is completing an installation for the electric disemulsification of crudes. In the same refinery an ultra-modern tubular plant working at atmospheric pressure has been put in operation for the production of a high grade stabilized gasoline, by automatic control.

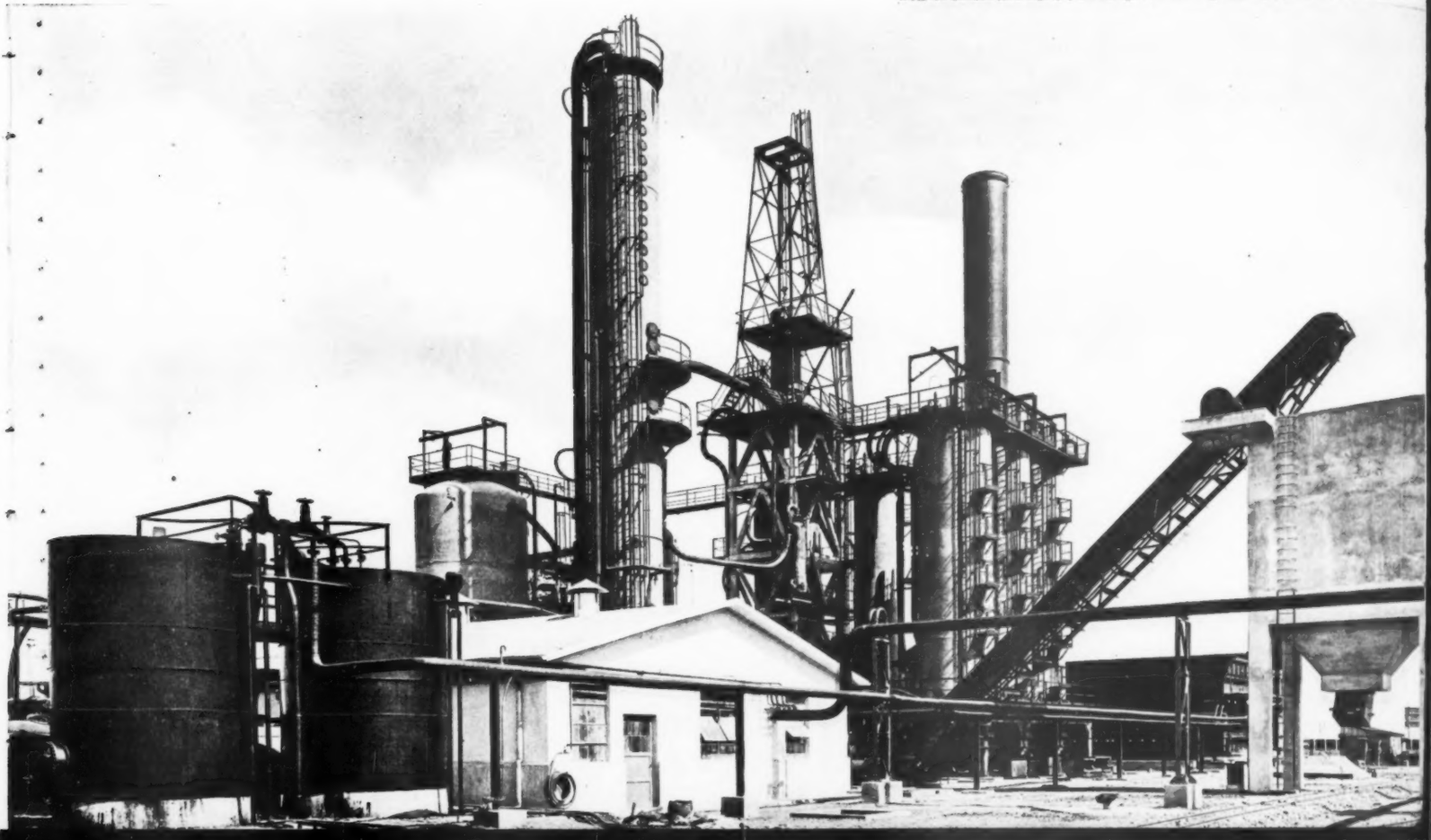
The trend in Roumanian refinery design and construction in recent years is toward plants capable of a higher yield of quality products.

Roumanian Cracking Plants

Refinery	Yearly Cracking Capacity (Tons)	Actually Cracked in 1936 (Tons)
Astra Romana	510,000	457,253
Steaua Romana	340,000	275,614
Romano-Americana	300,000	220,676
Creditul Minier	162,000	140,232
Colombia	36,000	25,487

Roumanian refineries are to produce the oil products which will replace domestic crude oil exports.





SPECIALTY PLANT Added to Anglo-American's Ellesmere Port Installation

Another Step in Modernization of British Refineries Is Represented by the Special Solvent and White Spirit Distillation Units Recently Completed at the Manchester Ship Canal for Anglo-American.

London, December, 1937.

QUIETLY but none the less effectively the major petroleum refiners in Britain have been modernizing and expanding their plants during the last few years, employing the latest and most economical types of equipment in order to give consumers a wide range of products suitable for all uses and at the lowest cost. Probably no class of products is demanded in greater variety and with closer specifications than special solvents and white spirits.

Several of these new refining plants have recently been described in these columns; others, we hope, are to come from plants going up or older ones being expanded. The latest development, which we were permitted to inspect recently is Anglo-American Oil Company's new refinery for the manufacture of special solvents and white spirits. Probably no class of refined petroleum products is demanded by industry in greater variety and with closer specifications than these spirits. They are an essential raw commodity of innumerable processes of manufacture and yet the Government taxes such oils 8d. a gallon, thereby raising production costs of a wide range of finished articles to the consumer. Seed extraction, rubber solvents, dry cleaning, artificial silk, turpentine substitutes, paint thinners and the like are but a few of the many uses for these oils.

This new Anglo refinery has been erected on the company's large site at Ellesmere Port on the Manchester Ship Canal because, as E. Evans-Jones of the company's Engineering Department said at the luncheon following the inspection, "Our refiners and engineers still think Ellesmere Port is an ideal position in the country for refining purposes and its advantages are such that it will doubtless be expanded still further."

He also spoke of the great advances in British engineering to meet the demands of modern refining technique, especially in the complicated automatic control by instruments.

Ellesmere Port is conveniently located for importation of essential raw materials and as a centre for the distribution of refined products. This is especially the case with special solvents and white spirits, which enter so largely into the great industries of Lancashire and Yorkshire. Moreover the Anglo-American site afforded ample room for the erection of such a plant, another reason for erection being that rising demand for the company's products had long exceeded the capacity of the two older plants, at Barrow and Barton. Upwards of 4,500,000 gal. of various grades of Esso special spirit will now be produced at Ellesmere Port. And apart from these speciality products, this installation is also one of the largest of the company's centres for petrol and kerosene storage and distribution, and for ethyl blending.

Demand for white spirit and special solvents in the United Kingdom has continued to grow steadily in recent years. Recorded as "spirit, other than motor spirit," customs returns make this clear.

United Kingdom Consumption of White Spirit and Special Solvents

	Gallons
1933	23,478,085
1934	25,681,818
1935	27,098,828
1936	28,075,320
1937 (9 months)	23,807,623
1936 (9 months)	21,039,433

Unfortunately manufacture in domestic plants of this essential commodity has not kept pace with growth of demand during recent years.

Domestic Production and Export of White Spirit and Special Solvents

	Home Production	Exports in Million Gallons	Retained Home Production
1933	20.7	2.0	18.7
1934	24.4	1.9	22.5
1935	20.1	1.5	18.6
1936	17.9	0.7	17.2

This new plant should help to improve the situation as to domestic manufacture of these refined products and bring about a recovery in their export trade.

Decision to erect the new plant was made in 1934 and the contract was placed in 1935 with Alco Products, Inc., Anglo American experts collaborating with Alco in the design. Foundations were laid early in 1936 and plant erection proper was completed early this year. Contrary to normal practice, the plant was brought into operation by the company's own staff, and has been in full and satisfactory commission for some months.

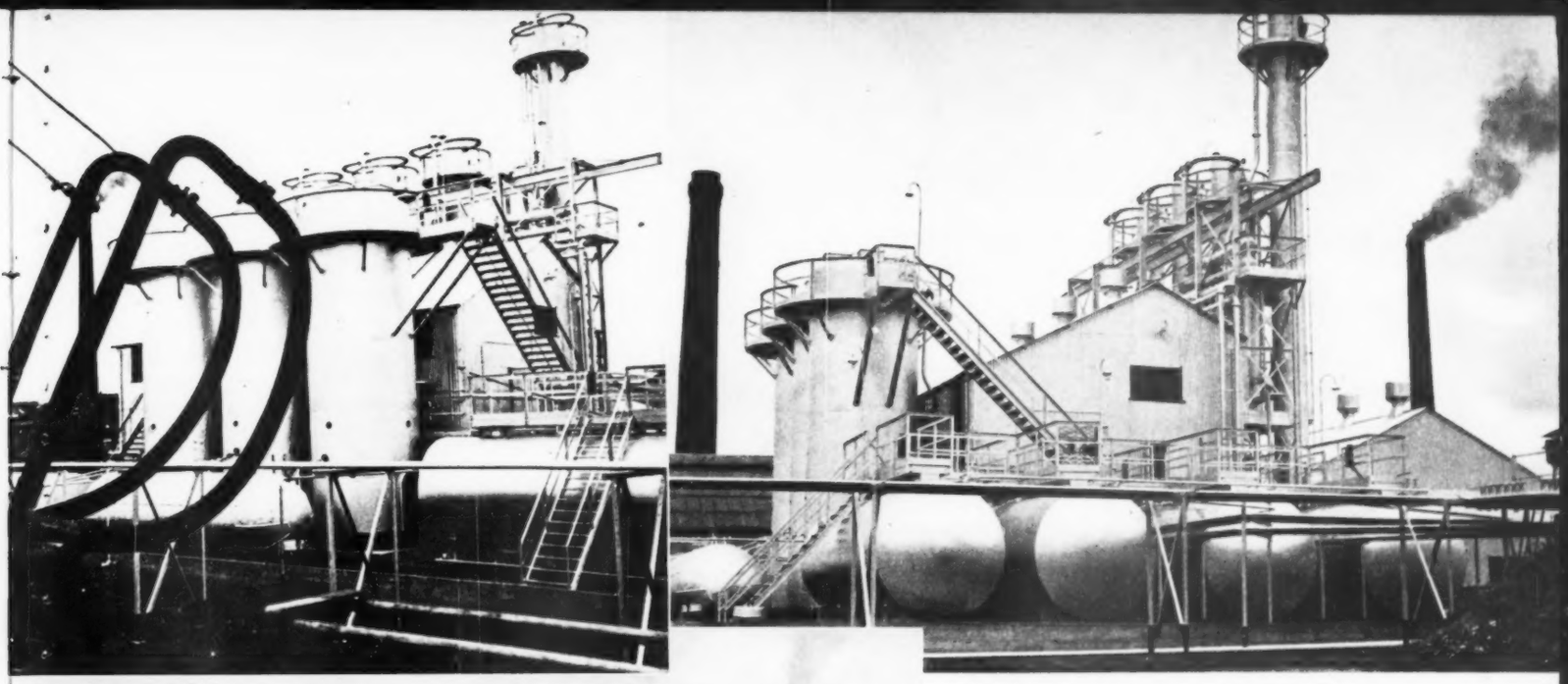
Before describing the main features of the distillation plant, mention may be made of some of the accessory plant and tankage constructed simultaneously.

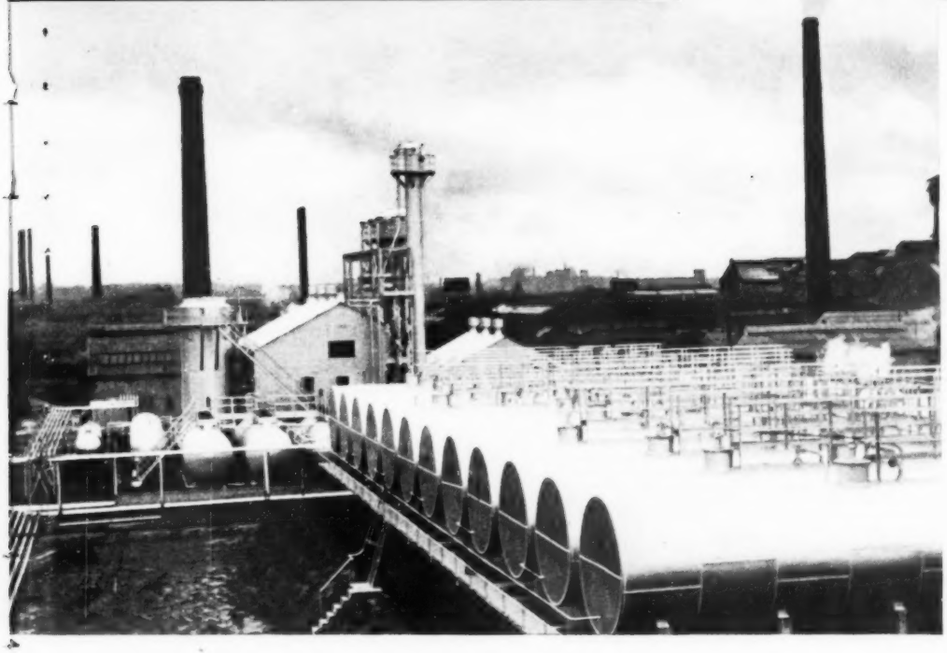
Five vertical tanks, with total capacity of 2,500,000 gal. were laid down for raw stocks, and four vertical and 24 horizontal tanks for storage of finished products with 640,000 gal. total capacity. The latter tanks are supported overhead by a particularly fine reinforced concrete structure—believed to be one of, if not the largest single structure gantry in Britain—permitting gravity loading of rail tank cars and barges. A new platform has also been erected for loading rail vehicles and a warehouse with complete facilities for filling barrels and smaller packages. Boiler house capacity has been increased by the installation of two oil-fired Lancashire boilers, with economizers and superheaters, each capable of evaporating 10,000 lbs. of water per hour.

The main section of the plant is the Alco continuous white spirit distillation unit, having a fractionating tower 3 ft. in diameter and 65 ft. 6 in. high, fitted with 30 streamline bubble trays. The feed is a wide boiling range crude white spirit, preheated by pumping through overhead vapor and side-stream tubular exchangers, and enters the tower above either the seventh or ninth trays, there being alternative nozzles. A steam heated reboiler supplies the necessary reboiler heat to the base of the tower, while open steam is also admitted to the reboiler, and to the base of the tower if required. Full use is made of pump exhaust steam for this purpose.

Main white spirit product is withdrawn from a tray in the upper portion of the tower, and rectified when necessary in an external four-tray stream-stripping section. The net yield of white spirit flows by gravity from the stripper through the side stream heat exchanger, and hence through a water cooler to receivers.

A narrow fraction is taken off as overhead vapor from the tower. It is condensed with the process steam and sub-cooled by passing successively through the vapor heat exchanger and a water condenser. The mixed condensate flows to a drum, from which the water is removed continuously by decantation. The required amount of oil condensate is withdrawn and returned by pump to the top of the tower as reflux. Surplus net yield of the top fractions flows by gravity to storage. Bottoms are pumped from the reboiler through a water cooler to storage. Control of reflux quantity and





Distillation and treating plant at Ellesmere Port from various angles—showing the counter-balanced loading pipes for rail tank cars, fractionating towers, washers and some of the product receivers.

rate of side-stream withdrawal is by means of micrometer valves located on an instrument panel in the still houses. All pumps on the still are of simplex steam-driven type.

Designed capacity of the unit is 6,670 gal. of crude white spirit per day, the yield of main side-stream product being 85-90 percent of the charge. The efficiency is such that a nil overlap between cuts is easily maintained.

Following considerable discussion it was decided that stills of the intermittent batch type with modern Alco fractionating towers were the most effective for the production of special solvents. Capacity required was low, while the cuts to be produced were numerous and consisted largely of narrow boiling range solvents.

Accordingly three shell stills, each of 6,650 gal. capacity, were provided. The charge consists of raw benzines, which are treated before distillation. Heat is applied by admitting steam to closed coil elements located in each still. Open steam may also be admitted if required. The vapors pass into fractionating towers, each 3 ft. in diameter by 51 ft. high, fitted with 19 Alco streamline trays. They leave overhead, are condensed in water-cooled tubular units, and condensate in each case flows into a small drum. Reflux is withdran from here and returned by pump to the tower top, the surplus overflowing to a nest of 12 receivers, each of 2,000 gal. capacity. Products are then transferred to main storage. Reflux is again controlled by means of Alco micrometer valves situated on the instrument panel.

Stills are capable of distillation down to one to two percent residue, working on a 48-hour cycle and the total capacity being over 10,000 gal. of raw benzine per day. Fractionating efficiency is such that cuts of 10 deg. C. to 15 deg. C. boiling range are obtainable on first distillation.

Treatment of both white spirit products and raw benzines is by the conventional method of sulphuric acid, caustic soda solution and water. There are three units, one for white spirit having an agitator of 10,000 gal. capacity and two for benzines, each of 7,000 gal. capacity. Each unit is furnished with a 100-gal. acid blow case. Caustic soda solution is prepared in a mixing tank equipped with water, steam and air inlet nozzles, and is charged to the agitators by means of a 1½ h. p. motor-driven centrifugal pump. Agitation is by circulation with motor-driven centrifugal pumps.

Steam is supplied at a pressure of 140 lb. per square inch, superheated to 400 deg. F., and total consumption at full capacity is approximately 3,700 lbs. per hour. As already mentioned, pump exhaust is fully utilized on the continuous unit reboiler. Cooling water is drawn from the Manchester Ship Canal, and is returned to the canal through a circular main.

The plant is adequately equipped with Foxboro control instruments, all meters and control valves being centralized on the panel in the still house. Automatic controls have been installed wherever possible, bringing the plant fully into line with the most recent developments. Transfer of all products is through a centralized hose manifold system, with eight motor-driven pumps.

OIL SECURITIES VALUE Decreased More Than $2,000,000,000 in 1937

By Howard G. Borden

THE accompanying article attempts to measure the total fluctuations of securities in the petroleum industry which are traded in on the New York Stock Exchange and the New York Curb Exchange. The stock exchange has reported a current monthly series of the total of all securities listed and has broken this down into common stocks, preferred stocks and bonds. It has also broken it down by industries. Common stock values, preferred stock values and the bond values have been summed up here to obtain the total value of all oil and natural gas securities. Table I shows this by months in millions of dollars from the end of July 1929 to the end of December 1937.

A drop of 72 percent from the high point of 8282 millions of dollars in August 1929 to 2257 millions in May and June 1932 is shown in the first half of this table. By July 1937 much of this ground was recovered and the total stood at 7577 millions of dollars, only 8.5 percent below the high of 1929. From that point the falling off has been rapid and at the end of the year the total stood at 5088 millions of dollars[1], a decrease of 39 percent from the 1929 figure and of 33 percent from the figure of July 31, 1937.

At the end of May 1932 petroleum shares were valued at 10.8 percent of all shares listed on the New York Stock Exchange. At the end of July 1937 they were 11.1 percent showing a fairly constant ratio. This indicates that the fluctuations are principally in the general market rather than peculiar to the petroleum industry.

Next comes the question of the New York Curb Exchange. The curb exchange does not make such a breakdown as described above so that it was necessary to compute comparable figures for selected dates. The total market value for petroleum shares traded in on the New York Curb Exchange was 1705 millions of dollars on December 31, 1937. (Table III). Changes in listings and reorganizations made comparisons difficult for previous periods. A group of the most prominent companies, comprising 1509 millions or 88.5 percent of the total

[1]As this article goes to press before the publication of the stock exchange figures it was necessary to compute this valuation from closing or bid prices of December 31st rather than use the bid prices which the exchange uses throughout. See Table II.

TABLE I

Market Value of Securities in the Petroleum Industry Listed on the New York Stock Exchange

(Millions of Dollars at end of month)

Year.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1929							7478	8282	8083	7375	7025	6987
1930	7095	6671	7708	8193	7913	6824	7141	7112	6046	5540	5278	4718
1931	4851	5090	4441	3867	3400	3871	3761	4239	3169	3479	3229	2638
1932	2567	2723	2698	2411	2257	2257	2936	3361	3053	2979	2891	2875
1933	2754	2431	2469	3250	3788	4180	3742	4366	4297	4072	4555	4507
1934	4875	4716	4681	4595	4387	4403	4017	4627	4474	4238	4399	4439
1935	4259	4028	3894	4414	4536	4567	4547	4359	4232	4821	4858	5487
1936	6176	6211	6302	5714	5678	5766	6140	6074	6156	6688	6717	7186
1937	7333	7392	7194	7309	7247	7077	7577	7071	6169	5805	5089	5088

(Source: New York Stock Exchange and Table II.).

TABLE II.

Market Value of Securities in the Petroleum Industry Listed on the New York Stock Exchange. Value as of December 31, 1937.

Company	Common Stocks			Preferred Stocks			Bonds		
	Shares Outstanding	Bid or Last Price	Value Millions	Shares Outstanding	Price	Value Millions	Par Value	Price	Value Millions
Amerada Corp.	922075	57¼	52.8						
Atlantic Refining Co., Ltd.	2696642	19¾	53.3	148000	104	15.4			
Barnsdall Oil Company	2258779	13¼	29.9						
Colonial Beacon Oil Co.	1444970	31	44.8						
Consolidated Oil Corp.	14218835	8⅞	126.2	55851	100	5.6	48500000	101¾	49.4
Continental Oil Co.	4738593	28¾	136.2						
El Paso Natural Gas Co.	593743	18¼	10.8				7035000	106¼	7.5
Houston Oil Company of Texas	1085597	6¼	6.8				7505500	99½	7.5
Indian Refining Co.	1270207	6	7.6						
Mid-Continent Petroleum Corp.	1857912	17¾	33.0						
Ohio Oil Co.	6563377	12½	82.0						
Pan American Pet. & Transport Co.	4702481	7½	35.3						
Pan Handle Eastern Pipe Line							24000000	100	24.0
Panhandle Producing & Refining Co.	198770	1⅛	.2	17504	36¾	.6			
Phillips Petroleum Co.	4449052	38	169.1						
Pierce Oil Corp.				150000	6¼	.9			
Plymouth Oil Co.	1050000	17	17.9						
Pure Oil Co.	3982031	11	43.8	282809	94	26.6			
Pure Oil Co.				71350	111 H	8.0			
Quaker State Oil Refining Corp.	927305	15⅛	14.0						
Richfield Oil Corp. of Del.	3986639	5⅛	20.4				7663765	88¼	6.8
Seaboard Oil Co. of Delaware	1244383	20¼	25.2						
Shell Union Corp.	13070625	16¼	212.5	370042	96¾	35.8	58115000	98¼	57.2
Simms Petroleum	500000	3	1.5						
Skelly Oil Co.	1008549	27¼	27.5	66300	88¾	5.9	9000000	97	8.7
Socony-Vacuum Oil Company, Inc.	31708452	14⅞	471.7				50000000	106¼	53.2
Standard Oil Co. of California	13102900	28¾	376.7						
Standard Oil Co. of Kansas (Del.)	160000	34	5.4						
Standard Oil Co. of New Jersey	26224767	45¼	1186.7				85000000	100⅝	85.5
Standard Oil Co. (Indiana)	15202441	33⅛	503.6						
Sun Oil Company	2328380	46½	108.3	100000	120	12.0			
Superior Oil Corporation	1388979	2¼	3.1						
Texas Corporation	11386253	39¼	447.1				60000000	105¾	63.5
Texas Gulf Producing Co.	889606	27	24.0						
Texas Pacific Coal & Oil Co.	932403	7½	7.0						
Tide Water Associated Oil Co.	6369597	14¼	90.8	500000	73	36.5	39250000	100	39.3
Union Oil Co. of California	4666270	18¾	87.5				8026500	117	9.4
Union Oil Co. of California							10000000	109½	11.0
United Carbon Company	397885	37¾	15.0						
Wilcox (H.F.) Oil & Gas Company	431443	2¼	1.0						
Mission Corporation	1244000	15¼	19.0						
Pacific Western Oil Corp.	1000000	11¾	11.8						
TOTALS			4510.8			155.2			422.5

GRAND TOTAL.....$5,088,472,649

was selected and market values computed for the low prices of 1932 and for February 1937. The increase during this period was from 426.1 millions to 2125.3 millions, an increase of 400 percent while the New York Stock Exchange increased 227 percent. The drop since February 1937 is 29 percent for this index of the curb exchange as against 31 percent for the stock exchange.

If the two exchanges are added it is seen that investments as of December 31, 1937, were 6794 millions. If we now assume that the proportion of our index to the total of the industry in the curb market remains constant at 88.5 percent we find the total for the curb exchange to be 2400 millions on February 27, 1937. This added to the 7392 millions for the stock exchange gives 9792 millions for the total for the industry, giving a composite loss of 30.6 percent for both exchanges for the period from February 1937 to January 1, 1938.

On the basis of the low prices for 1932 the total value of the securities in our index (curb only) is only 426.1 millions of dollars. Dividing this by .885 gives the total curb market value to be about 481 millions. Adding this to the 2257 millions which was the low of the stock exchange gives us 2738 millions for total value of securities on both markets for the low of 1932 or less than one-half of the figure for February 27, 1937.

The parallelism of the total market and the market for petroleum shares indicates that factors outside of the industry control the prices of its securities so that the market value of these securities cannot be taken as a reasonable estimate of the intrinsic value of the industry. On the other hand the fact that over 10 percent of all shares traded in on the New York Stock Exchange are in the petroleum industry does give us an idea of the relative importance of petroleum as a basic industry.

Caution should again be uttered that these figures are in no way a measure of the total value of the industry. First, there are many duplications caused by holdings of one company by another and that perhaps by a third. The other exchanges and the open market for securities are omitted and if used would involve other duplications due to trading on two or more exchanges.

TABLE III.

Market Value of Securities in the Petroleum Industry Traded in on the New York Curb Exchange. Value as of December 31, 1937 (# Used in Index)

Company	Common Stocks			Preferred Stocks			Bonds		
	Shares Listed	Bid or Last Price	Value Thousands	Shares Listed	Price	Value Thousands	Par Value	Price	Value Thousands
American Maracaibo Co.	1778415	¼	1445						
Ashland Oil Refining Co.	1000000	3¾	3750						
Buckeye Pipe Line Co.	200000	37	740						
Carid Syndicate, Ltd.	799020	1	799						
Cities Service Co. #	37804394	1⅞	70883	1160931	37¾	43825	13734400	62	7142
Cities Service Co.				373000	3	1119	115128700	56¾	65336
Cities Service Co.				72295	30	2169			
Colon Oil Development Co., Ltd. #	2200000	2⅝	5775	651119	4⅛	2686			
Columbia Oil & Gasoline Corp. #	2336826	3⅝	8471						
Consolidated Royalty Oil Co.	552926	1¾	968						
Continental Oil Co. of Mex.	2000000	⅝	1250						
Corden Oil Co. of Maine	462551	1⅝	752	43992	10¾	473			
Creole Petroleum Corp. #	6975383	23	160434						
Crown Central Petroleum Corp.	825720	4⅛	3406						
Crystal Oil Refining Corp.	102587	⅞	90	25035	6½	163			
Darby Petroleum Corp.	351390	7¼	791						
Darby Oil & Refining Corp.	271529	3	815	50000	60	3000			
Empire Gas & Fuel Corp. #				72645	39	2835			
Empire Gas & Fuel Corp.				34000	35	1190			
Empire Gas & Fuel Corp.				305066	36½	11135			
Empire Gas & Fuel Corp.				132536	36	4771			
Empire Oil & Refining Co. #							19446800	72	14002
Eureka Pipe Line	50000	27	1350						
Gulf Oil Corporation #	9276202	38⅛	353655						
Humble Oil & Refining Co. #	9000000	65	585000						
Indian Territory Ill. Oil #	1304600	1⅛	1466						
Indian Territory Ill. Oil	7090036	1⅛	7976						
Indiana Pipe Line Co.	300000	7	2100						
Kirby Petroleum Co.	500000	3⅛	1563						
Leonard Oil Development Co.	2000000	⅛	1125						
Lion Oil Refining Co.	434820	18⅝	8099						
Margay Oil Corp.	150110	19¾	2965						
Mexico-Ohio Oil Co.	500000	¾	375						
Michigan Gas & Oil Corp.	196350	3⅝	712						
Middle States Pet. Corp.	299954	2¾	825				1843400	75	1382
Middle States Pet. Corp.	895529	½	448						
Midland Oil Corp. #				34400	4⅜	151			
Mountain Producers Corp.	1682182	5	8411						
Midwest Oil Co.	998464	6⅞	6864						
National Oil Products Co.	169128	17	2875						
New Bradford Oil Co.	1500000	4⅞	7313						
North European Oil Corp.	1692291	⅛	212						
Navarro Oil Co.	360000	4¼	1530						
No. Central Texas Oil Co., Inc.	270000	3¾	1013						
Northern Pipe Line	120000	6¼	750						
Ohio Oil Co. #				548077	108¾	59603			
Pantepec Oil Co. of Venezuela #	2437892	5⅝	13713						
Penn-Mex Fuel Co.	400000	3¼	1300						
Producers Corp.	765037	⅛	96						
Red Bank Oil Co.	237099	2⅞	682						
Reiter-Foster Oil Corp.	652600	⅛	204						
Root Petroleum Co.	336045	2⅝	882	41645	9¼	385			
Ryan Consol Pet. Corp.	298532	3	896						
Savoy Oil Co.	150000	1¼	188						
South West Penn. Pipe Lines	35000	22½	788						
Southern Pipe Line Co.	100000	4⅛	413						
Standard Oil of Kentucky #	2604801	16¾	43630						
Standard Oil of Nebraska	172503	9	1553						
Standard Oil of Ohio #	756265	18⅝	14085	120000	100	12000			
Sunray Oil Corp. #	2005163	2⅞	5765	40600	34	1380			
Swan Finch Oil Corp.	34840	6¼	218						
Texon Oil & Land Co.	936025	4⅛	3861						
Universal Consolidated Oil Co.	200000	9	1800						
Venezuelan Petroleum Co.	2000000	1⅛	2250						
Venezuelan Mexican Oil Corp.	219581	3⅛	686						
Wellington Oil of Del.	850000	2¼	1913						
Woodley Petroleum Co.	278250	6⅛	1704						
TOTALS			1470617			146785			87861
						GRAND TOTAL			$1,705,263,701

INTERNATIONAL NEWS
And Reports

HIGH-SPEED TANKERS FOR JERSEY STANDARD

Contracts have been signed by Standard Oil Company of New Jersey and four American shipbuilders for the construction of twelve fast tankships intended, primarily, as auxiliaries to the United States Navy. The new vessels were contracted under provisions of the Merchant Marine Act, authorizing the government to pay for installation of national defense features on new commercial vessels.

These twelve ships each will have a deadweight of 16,300 tons and cargo capacity of 150,000 bbl. Apart from a test speed of 18 knots and sustained sea-speed of 16½ knots when loaded they will be equipped with many defense features required by the Navy. They will be twin-screw ships 525 ft. long. Propulsion is to be by geared turbine engines, probably 12,800 h.p.

The cost per vessel will be $3,129,667, making a total of $37,556,004, to be expended on the entire group. Of the total amount the government will provide $10,563,000. Inasmuch as a single tanker of this type would cost from $8,500,000 to $9,000,000 to build, the navy is getting twelve vessels at a cost slightly more than a single order on its own account. The shipyards which will be constructing these auxiliaries are: Newport News Shipbuilding and Drydock Company, Bethlehem Shipbuilding Corporation at its Baltimore yards, Sun Shipbuilding and Drydock Company, and the Federal Shipbuilding and Drydock Company, each building three tankers.

Jersey Standard has agreed to maintain these vessels in operating condition, at its own expense, for a period of twenty years, but it is reported possible that other oil companies may take over certain of these vessels. Inasmuch as the Maritime Commission proposed two distinct tanker types, and 20 initial orders, it is likely that another eight tankers will be later contracted for: vessels from 2,000 to 4,000 tons less in deadweight, due to the smaller operating requirements of other companies.

BRITISH OIL IMPORTS

BRITISH petroleum imports reached a high figure in November, 1937, the total of crude and all products being 7,715,000 bbl. This compares with 7,186,000 bbl. in October, 1937, and 6,172,000 bbl. during November, 1936. Compared with November, 1936, rises occurred in all categories except gas oil, and were most pronounced in crude oil, gasoline and lubricating oil. Gasoline imports in November, 1937, at 3,725,000 bbl. against 2,821,000 bbl. in the corresponding month of 1936, were at a high level for a time of year when private motoring demand for fuel is relatively small. A large part of the improvement was due to greater arrivals from Netherlands West Indies. Explanation of the relatively small arrivals of gas oil is suggested by heavy imports during preceding months. For the eleven months to November 30th, 1937, imports of this product show a larger percentage increase on 1936 than any other of the main categories.

British Oil Imports by Products

	Nov. 1937	11 mos. to Nov. 30 1937	11 mos. Nov. 30 1936
		(Barrels)	
Gasoline	3,725,000	36,087,000	33,366,000
Kerosene	532,000	5,767,000	5,618,000
Gas oil	146,000	3,544,000	2,876,000
Lubricating oil	289,000	3,115,000	2,996,000
Fuel oil	1,563,000	18,387,000	17,864,000
Other sorts	17,000	440,000	451,000
Refined products	6,272,000	67,340,000	63,171,000
Crude oil	1,443,000	14,247,000	13,606,000
Total imports	7,715,000	81,587,000	76,777,000

CRACKING PATENT AGREEMENT

AN AGREEMENT which is expected to aid in clearing up the patent situation affecting cracking processes and in reducing litigation among the holders of these patents was concluded early in December, 1937, between The Texas Company and Universal Oil Products Company.

By payment of a substantial sum, Universal Oil Products Company receives a non-exclusive right to grant licenses under the cracking patents controlled by Gasoline Products Company and its associates and also under patents held by The Texas Company. The Texas Company owns the Behimer patents covering clean circulation, which was developed at its Port Arthur refinery for use in the Holmes-Manley process and is largely employed in modern cracking processes. The patents were involved in many interference contests and The Texas Company has been fighting in the courts for several years to obtain recognition, which is practically extended by the present agreement.

Immediately following the signing of the agreement, The Texas Company moved to dismiss suits which it had been prosecuting under the Behimer patents against National Refining Company, Fort Scott, Kansas; Solvex Refineries Inc., Tyler, Texas; and Sunray Oil Company, Tulsa, Okla. All three of these were licensees of Universal Oil Products Company.

Similarly, suits which Gasoline Products Company had brought against Waggoner Refining Company, Wichita Falls, Texas, and National Refining Company, Toledo, Ohio, licensees of Universal Oil Products Company, are to be discontinued.

To make the agreement with Universal more complete, it was affirmed by Standard Oil Company (New Jersey), Standard Oil Company (Indiana), Atlantic Refining Company and Gulf Oil Corporation, original holders of cracking patents now being licensed by Gasoline Products Company. Consequently, Universal Oil Products Company is placed in a position where it can issue licenses for the operation of practically all the leading cracking processes in general use at the present time and can assure licensees against infringement suits.

Another provision of the agreement gives the companies now operating under licenses from Gasoline Products Company the right to acquire immunity under the patents of Universal. In this connection the suit brought by Universal against Chalmette Petroleum Corporation, New Orleans, La., has been dismissed.

The rights extended to Universal Oil Products Company are non-exclusive and Gasoline Products Company has retained the right to grant licenses under its own patents as heretofore, but the agreement carries no provision for the future issuance of licenses by Gasoline Products Company under Universal Oil Products Company patents.

INTERNATIONAL VISITORS FOR TULSA OIL SHOW

TULSA, Okla.—President W. G. Skelly has announced that the delegates and representatives, of from 20 to 25 countries, are expected to attend the Tenth International Petroleum Exposition, meeting May 14th to 21st at Tulsa, Oklahoma. These visitors will be taken on special tours and to special lectures, by the International Committee.

James H. Gardner, president of the Gardner Petroleum Company and chairman of this committee, said that the tours for the international delegates will be made through the larger refineries and oilfields of the Mid-Continent, the largest producing area in the world. Discussions and displays of the latest developments of the portable rotary, seismograph and aerial photography will give them an opportunity to see the latest developments. There will also be a comprehensive tour of the exposition in which the latest methods and most modern equipment will be explained to the delegates by guides.

WORLD OIL PRODUCTION—Official Figures

All figures furnished direct to WORLD PETROLEUM by governments, except where otherwise specified—Table revised monthly

(Figures in U. S. barrels of 42 gal.—Conversion ratios used where statistics are received in tons are weighted averages for individual countries)

Country	December 1936	January 1937	February 1937	March 1937	April 1937	May 1937	June 1937	July 1937	August 1937	September 1937	October 1937	Preliminary Figures November 1937
United States	97,652,000	98,567,000	93,173,000	106,724,000	104,979,000	110,911,800	105,812,000	110,721,000	115,090,000	109,980,000	110,911,000	107,500,000
Russia[2]	17,413,623	16,117,461	13,796,325	15,907,051	16,401,771	18,130,230	17,953,812	18,580,752	15,830,000[1]	16,663,000[1]	17,600,000[1]	16,923,000
Venezuela	8,171,274	9,559,158	13,130,903	15,066,287	14,686,657	14,498,968	16,260,492	16,469,071	17,861,784	17,640,872	17,979,227	15,114,000
Roumania	5,050,000	4,768,000	4,217,000	4,595,000	4,412,000	4,494,000	4,151,000	4,317,000	4,293,000	4,256,000	4,313,000	4,324,000
Iran[3]	5,355,786	5,665,500	4,766,574	6,330,252	6,224,496	6,247,158	6,639,966	7,093,206	7,191,408	7,078,098	7,100,000[1]	7,000,000
Netherland India	4,433,034	4,267,148	4,011,266	4,405,436	4,348,185	4,553,298	4,464,725	5,208,460	4,888,298	4,586,630	4,766,689	4,600,000
Mexico	4,259,733	4,233,635	3,922,929	4,307,952	4,249,838	3,387,950	3,338,311	3,848,587	2,800,868	3,432,101	4,372,808	4,211,000
Iraq[4]	2,161,140	2,638,745	2,386,687	2,709,260	2,665,259	2,747,102	2,344,213	2,429,587	2,429,787	2,513,145	2,663,244	2,500,000
Colombia	1,641,636	1,668,490	1,617,441	1,622,226	1,660,469	1,678,580	1,724,173	1,681,799	1,592,592	1,617,433	1,811,759	1,797,625
Peru[5]	1,506,716	1,462,871	1,335,130	1,479,964	1,426,891	1,451,220	1,427,939	1,484,382	1,835,800	1,448,464	1,484,761	1,428,079
Argentina	1,356,396	1,355,029	1,237,459	1,317,000[1]	1,267,000[1]	1,270,000[1]	1,278,000[1]	1,280,000[1]	1,296,000[1]	1,270,000[1]	1,268,000[1]	1,230,000
Trinidad	1,231,365	1,263,456	1,157,408	1,287,097	1,301,260	1,351,198	928,752	1,377,547	1,433,474	1,358,600	1,393,317	1,360,000
Burma	644,322	583,428	601,638	635,792	625,937	690,501	638,874	675,000[1]	650,000[1]	640,000[1]	660,000[1]	653,000
Bahrein[6]	619,910	730,064	549,260	799,994	659,557	432,748	684,348	585,917	254,937	662,861	701,000[1]	700,000
Poland	325,940	300,886	295,620	316,844	318,360	318,360	310,780	318,360	299,460	310,780	312,000[1]	310,000
Brunei[7]	351,025	386,181	356,897	389,612	363,226	376,191	349,500	353,313	373,760	341,111	351,711	376,487
Germany	277,269	263,369	231,466	243,012	247,060	245,088	249,434	267,847	279,727	282,155	288,926	260,000
Japan[8]	212,326	219,410	194,037	207,423	198,898	206,544	200,092	204,710	214,819	205,914	208,000[1]	209,000
British India[12]	164,896	174,507	155,219	167,418	162,699	172,458	181,436	190,000[1]	201,000[1]	210,000[1]	200,000[1]	180,000
Ecuador	175,918	180,058	160,675	180,727	181,352	189,658	182,711	186,175	184,780	178,122	182,053	176,252
Sarawak[9]	139,708	136,658	124,609	136,887	130,481	134,523	131,625	143,445	138,031	134,311	133,684	126,439
Canada[10]	139,701	141,078	153,906	175,575	188,014	192,845	209,181	241,737	288,934	298,753	342,452	340,000
Egypt[11]	98,602	99,518	86,780	93,432	89,480	97,077	98,021	99,182	97,818	100,699	97,203	95,082
France	41,755	37,148	39,990	43,053	41,861	42,096	45,445	42,125	43,367	44,000[1]	41,000[1]	42,000
Czechoslovakia	9,632	9,311	9,595	9,383	9,574	8,824	10,824	11,529	10,125	9,667	9,500[1]	9,300
Other countries[1]	28,000	28,000	30,000	30,000	34,000	36,000	33,000	30,000	28,000	31,000	34,000	31,000
Total	153,461,707	154,856,099	147,741,814	169,180,777	166,873,325	173,864,417	169,648,654	177,840,731	179,607,769	178,195,716	179,225,334	171,496,264

[1]Estimate. [2]Russian Sakhalin included with Russia. [3]Anglo-Iranian Oil Company Ltd. figures revised, fuel oil returned to ground has been deducted. [4]Iraq Petroleum Company Ltd. export figures. [5]International Petroleum Company and Lobitos Oilfields Ltd. figures combined. [6]Bahrein Petroleum Company Ltd. figures. [7]British Malayan Petroleum Company Ltd. figures. [8]Japanese Sakhalin, Taiwan (Formosa) and Hokkaido included with Japan. [9]Sarawak Oilfields Ltd. figures. [10]Includes natural gasoline production. [11]Anglo-Egyptian Oilfields Ltd. figures. [12]Excluding Burma.

Official Crude Oil Production Figures for 1932 to 1937

	Daily Average to Nov. 30 1937	Daily Average 1936	Total to Nov. 30 1937	Total 1936	Total 1935	Total 1934	Total 1933	Total 1932
United States	3,516,074	3,001,410	1,174,368,800	1,098,516,000	996,596,000	908,065,000	905,656,000	785,159,000
Russia	550,609	545,453	183,903,402	199,635,921	184,008,033	175,635,783	155,596,429	155,927,997
Venezuela	503,794	424,237	168,267,419	155,270,840	148,809,057	136,098,681	117,113,940	115,615,782
Roumania	144,132	173,587	48,140,000	63,532,846	61,270,072	61,849,306	53,919,708	53,651,978
Iran	212,411	169,176	70,945,250	61,928,591	56,560,863	56,937,308	53,532,977	48,691,634
Netherlands India	150,000	131,043	50,100,135	47,961,744	45,307,913	45,107,828	41,234,498	37,988,913
Mexico	132,054	112,098	44,105,979	41,027,915	40,240,563	38,171,946	34,000,830	32,805,496
Iraq	83,089	81,730	28,013,884	29,913,150	27,410,983	7,639,849	1,094,915	871,840
Colombia	55,307	51,246	18,472,587	18,756,110	17,597,655	17,337,900	13,156,126	16,415,214
Peru	48,699	48,068	16,265,501	17,593,069	17,056,555	16,314,381	13,257,318	9,899,265
Argentina	42,121	42,235	14,068,488	15,457,960	14,297,025	14,021,901	13,690,556	13,138,747
Trinidad	42,521	36,167	14,212,109	13,237,030	11,671,224	10,894,363	9,561,353	10,126,121
Burma	24,882	20,731	8,310,722	7,587,718	7,181,113	7,278,859	7,114,311	7,073,437
Bahrein	20,242	12,690	6,760,686	4,644,635	1,264,807	285,072	31,377	902
Poland	10,210	10,372	3,410,240	3,869,575	3,901,881	4,011,336	4,174,079	4,219,634
Brunei	12,382	9,009	4,175,767	3,269,938	3,302,905	2,705,350	2,035,656	1,200,026
Germany	8,557	8,389	2,858,084	3,076,858	2,967,438	2,204,402	1,656,602	1,594,807
Japan	6,793	6,568	2,268,847	2,403,072	2,294,878	1,872,837	1,504,412	1,683,439
British India	5,972	5,405	1,994,737	1,978,329	2,037,810	1,921,863	1,628,803	1,743,878
Ecuador	5,936	5,308	1,982,563	1,942,467	1,731,785	1,636,619	1,619,902	1,597,641
Sarawak	4,403	4,507	1,470,693	1,547,882	1,776,593	1,942,591	2,206,815	2,329,733
Canada	7,702	4,110	2,572,475	1,504,287	1,447,204	1,410,895	1,145,333	1,044,412
Egypt	3,156	3,392	1,054,292	1,241,550	1,234,170	1,501,624	1,625,895	1,854,057
France	1,383	1,562	462,085	534,063	529,664	700,000	786,366	755,146
Czechoslovakia	322	346	107,632	126,603	136,580	177,797	121,695	126,603
Other Countries	1,032	969	345,000	355,600	398,800	430,200	391,500	370,700
Total	5,593,783	4,910,008	1,868,637,377	1,796,913,753	1,651,031,571	1,515,153,691	1,437,857,396	1,305,886,402

POLAND PERTURBED By Weakened Condition of its Petroleum Industry

Government Now Beginning to Realize Danger of Obstructing Oil Business by Over-Legislation and Oppressive Taxation. Seeks to Assist Exploration to Offset Production Decline.

More intensive methods of crude production must eventually be resorted to in the Polish oilfields and a system of water flooding may have to be adopted to force the oil to available levels in the producing formations. In spite of considerable drilling activity during 1936 and subsequently, crude output has shown a steady decline for all fields. Increases have been effected at Jaslo and Stanislawow, but a marked decrease has been noticeable at Boryslaw (Drohobycz). The gross petroleum production of the Jaslo district, in 1936, increased 7.7 percent from 1935 while that of the Stanislawow district showed a 48 percent increase. Boryslaw district, however, suffered a fall of 13.1 percent in oil production.

Further declines were observed during 1937, for which year complete statistics are not available.

Natural gas output from Polish oilfields fell off in two areas, and only in the Stanislawow district was a gain made—merely a slightly better showing than the previous year, insufficient to offset the loss at other fields. The gas recovered from oil-producing areas is relatively small. It is not generally piped for consumption as a gas, but is mostly used to produce natural gasoline. The 23 gasoline extraction plants functioning in 1936 treated 869,286,000 cu. ft. of natural gas in contrast to 898,260,000 cu. ft. during 1935, and 338,980 bbl. of casinghead gasoline were obtained. This product is primarily used for mixing with ordinary gasoline. There are also extensive dry gas fields in Poland independent of the oilfields, principal of which are Dasrawa and Roztokia.

At the end of 1936, Poland's 3,600 wells, of which 3,180 were productive, yielded an average output per well of approximately 3¾ bbl. per day.

Total drilling in Poland during 1936 reached about 315,000 ft., of which 157,575 ft. were drilled at Jaslo, 128,205 ft. at Boryslaw, and at Stanislawow 60,770 ft. As a contrast to 1935 some 66,000 ft. more drilling was accomplished, and approached the 1930 figure (386,000 ft.), which was the country's record year. Relatively deep wells are not customary in Poland due to high cost of drilling to depths common in some other countries, and most wells are less than 5,000 ft.

Declining crude oil output is disturbing the government's peace of mind, and it is beginning to change its policy towards the oil industry. An idea of the situation may be obtained more readily when one considers that the production index for September, 1937, was 65.5 (based on the 1928 figure as 100). The Polish government proposes to encourage drilling by enacting new legislation of a more favorable type. It is reported that the government will increase its subsidy for exploratory drilling by 60 percent, and later raise it by 100 percent. This subsidy will be proportioned per 165 ft. of hole drilled.

Measures have been submitted to the economic committee of the Council of Ministers which will provide that oil claims are to be granted to exploring companies by the mining board in cases where the land owner is not engaged in drilling for oil. The board will attempt first to arbitrate the matter, but will otherwise authorize the discoveror's right to exploit the land despite the owner's objection. The latter will receive 5 percent of gas and oil produced, plus allowed damages for use of the land. Oil rights will be granted for 25 years, and may be renewed for a like period. On the motion of two-thirds of the parties engaged in drilling, the board is empowered to effect a mutual exploitation of the land in order to increase the output of crude oil.

According to technologists in Poland the country still has possibilities for discovery of new oilfields, but they are not optimistic. Traces of oil have been reported in Pomerania and in the new industrial district of Sandomierz and Volhynia.

The 27 oil refineries active during 1936 handled 3,617,571 bbl. of crude against the 1935 total of 3,767,884 bbl., from which a total of 3,205,352 bbl. and 3,338,839 bbl. of refined liquid products were obtained plus 25,050 tons and 25,110 tons of paraffin wax, respectively. Runs to stills rose, however, by about 103,500 bbl. to 1,883,882 bbl. during the first half of 1937.

Polish refineries run mainly for kerosene, as this is the most important product for domestic consumption. Due to the failing supplies of crude oil, it is considered quite probable that the refinery kerosene output and domestic consumption will be about equal in 1938. Such a situation will undoubtedly bring its problems, as it will mean that either refined kerosene will have to be brought into the country or importation of crude oil supplies must be permitted.

Stocks of crude oil at the Polish refineries at the end of 1936 amounted to 236,186 bbl.; stocks of refined products were 1,175,275 bbl., of which 156,740 bbl. were gasoline and 119,100 bbl. kerosene.

The domestic market for liquid petroleum products rose in 1936 to a total of 2,423,666 bbl., and this increase seems to have continued throughout 1937. Demand for gasoline during the first half of 1937 increased by 25 percent, and amounted to 441,150 bbl. in the first eight months. This growth of domestic consumption is closely related to the larger number of automotive units in use during the year. The Polish people lament the force of circumstances imposing considerably higher motor fuel prices at home for gasoline produced within the country than the same commodity sold in several markets abroad, but gasoline consumption has risen amazingly in the face of such prices, only due to the activity of motor transport.

Polish oil exports were down in 1936 compared with 1935, and this decline continued during 1937. A slight increase in shipments to Czechoslovakia was effected in 1936, while those to Gdynia rose threefold. Exports to Switzerland and Danzig declined considerably. Danzig and Gdynia are bunkering stations for motorships, and loom up prominently as export markets. Decline of total exports in 1937, first ten months, amounted to 24.6 percent and gives a good forecast of the whole year. Kerosene shipments are no longer a dominant factor, and surplus of other products continues to decline. Domestic demand has not yet reached pre-depression levels, and it is fairly obvious that at this rate Poland will soon be faced with the necessity of importing oil supplies to make up her deficit.

The falling off of Polish exports and increase in domestic consumption reveal an unsatisfactory condition in the oil business in that country, and it would seem that

there is unlikely to be even a temporary improvement under the present circumstances.

Realizing the danger, the government has begun to offer various facilities for assisting the oil industry—instead of oppressing it as in the past. It is granting official credits, release and respite from taxes, and financial assistance for exploratory drilling. Although belated, it is hoped that this new policy will serve to offset to some extent the errors and omissions of the past.

POLISH STATISTICS

AREA: 149,937 sq. mi. POPULATION: 33,823,000; inhabitants per sq. mi., 225.6.

PRINCIPAL INDUSTRIES: petroleum, coal, zinc, tin, iron and steel, salt, potash, sugar, timber and wood-working, textiles, chemicals, glass and paper.

RAILWAYS: 11,235 mi. standard gauge; 1,503 narrow gauge; total 12,738 mi.; engines, 5,440; passenger coaches, 12,294; passenger traffic, 138,200,000; passenger-mi., 2,852,400,000; freight cars, 155,942; freight traffic, 48,800,000 tons; freight ton-mi., 9,328,200,000.

HIGHWAYS: 204,989 mi., of which about 35,000 mi. are surfaced; area to mi. of road, 0.6 sq. mi.; 0.1 vehicle to mi. of road.

MOTOR VEHICLES: passenger cars, 20,338; buses, 1,543; trucks, 6,689; total registrations, 28,570; population per vehicle, 1,184.

MERCHANT MARINE: 48 steamships of 59,363 gross tons; 35 motorships and auxiliary sailing vessels of 36,386 tons; 13 sailing vessels and barges of 1,691 tons; total, 96 vessels of 97,440 tons gross register.

AVIATION: airliners, 42; total civil aircraft, 197; route mileage, 2,961; miles flown, 700,106; passengers carried, 15,325; passenger-mi. flown, 2,790,408; freight carried, 348.3 tons; freight ton-miles, 63,585; mail, 47.5 tons; mail ton-miles, 8,643.

RETAIL OIL PRICES AND TAXES (U.S. cents per gallon at Warsaw)—Aviation gasoline, including tax of five cents: 53 cents. Ordinary gasoline, including tax of 11 cents: 43 cents. Premium gasoline, including tax of ten cents: 46 cents. Kerosene, including tax of five cents: No. I, 39 cents in tins, 34 cents in bulk; No. II, 24 cents in tins, 23 cents in bulk. Lubricating oil, including tax of five cents: No. I, 251 to 267 cents; No. II, 178 to 243 cents; and No. III, 117 to 143 cents. The Polish market is supplied by products of domestic origin, except for some grades of cylinder oils and asphalt.

POLISH OIL EXPORTS BY PRODUCTS

Product Exported	Jan.-Oct. 1937 (Bbl.)	Jan.-Oct. 1936 (Bbl.)	Change in 1937 (Percent)	Year 1936 (Bbl.)	Year 1935 (Bbl.)	Change in 1936 (Percent)
Gasoline	342,728	398,174	—13.9	471,818	398,769	+18.4
Kerosene	77,182	177,382	—56.4	211,627	264,750	—20.3
Gas and fuel oil	170,201	155,404	+ 9.5	191,705	309,872	—38.2
Lubricating oil	134,459	224,569	—40.1	245,927	161,711	+52.1
Other products	—	—	—	27,769	21,686	+37.4
Total liquid exports	724,570	955,529	-24.2	1,168,846	1,156,788	+ 1.0
				(Tons)	(Tons)	
Paraffin wax	—	—	—	11,988	19,180	-37.4

Petroleum Production and Drilling

Year	Quantity (Bbl.)	Depth (ft.)
1932	4,219,634	193,000
1933	4,174,079	221,000
1934	4,011,336	257,000
1935	3,901,881	284,000
1936	3,869,575	249,000
1937*	3,722,000	315,000

*Preliminary estimate

Polish Refinery Output

Product	1936	1935
	(Barrels)	
Gasoline	747,405	727,005
Kerosene	1,091,325	1,105,050
Gas and fuel oil	645,467	691,437
Lubricating oil	440,805	521,347
Other products	280,350	294,000
Total liquid products	3,205,352	3,338,839
	(Tons)	
Paraffin wax	25,050	25,110

Polish Oil Consumption

Product	1936	1935
	(Barrels)	
Gasoline	543,371	524,390
Kerosene	959,902	917,947
Gas and fuel oil	422,284	395,981
Lubricating oil	301,731	293,132
Other products	196,378	183,862
Total liquid products	2,423,666	2,315,312
	(Tons)	
Paraffin wax	9,417	8,259

Foreign Oil Legion

WILLIAM H. BERG has been elected president of Standard Oil Company of California, succeeding the late K. R. Kingsbury. Mr. Berg is widely known throughout the oil industry, and is a director of the American Petroleum Institute. Although friendly with all of his associates, most of whom he calls by their first names, he is a most reserved and self-effacing man and is probably passed on the street without being recognized more often than any other official of the company. Mr. Berg's career is typical of that of many executives. Born at Tripoli, Iowa, in 1882, he went to California in search of employment at the age of 20, and obtained a post as stenographer with Standard of California, with which company he remained. Years later, in a rare moment of reminiscing, he told his associates that it was his ability to memorize the text of the dictation rather than proficiency at shorthand that earned him the job.

William H. Berg

Mr. Berg's career has several high-lights —on the morning of the great San Francisco earthquake, in 1906, he rushed to the office as soon as he could dress. Fires had already broken out, so he packed a suitcase with all of the right-of-way documents he could gather and carried them to safety. These he retained through the ensuing arduous times, while his own home was burned, and reported with his valuable salvage when later the company opened temporary offices in Oakland. In 1908 he entered the producing department as chief clerk, rising steadily to general manager of the foreign producing department in 1921 when the company's overseas holdings assumed importance. His work took him to various countries in Latin America. He filled this post with distinction until elected a director in 1924. Three years later he was elected a vice-president.

While for the last 29 years of his 35 years service Mr. Berg's chief interest has been in the development of crude oil production—the company's greatest success being the discovery of a major oilfield at Bahrein in 1931—he has had a broad experience in all branches of the company's business.

FELIX A. C. GUEPIN has been appointed executive vice-president of Shell Oil Company of California. He had previously been in the company's office in New York. Mr. Guepin has had long experience in other oil-producing countries, and has been active in the movement for world conservation of petroleum resources.

PROF. GORTANI, director of the Geological Institute of the University of Bologna, together with PROF. BIANCHI of the University of Padua, and ING. MIGLIORINI, geologist of Azienda Generale Italiana Petroli, are reported to have recently arrived in Italian East Africa to head geological parties in a second survey for possible petroliferous areas in Somaliland and Abyssinia. Work by a previous group in Harar was uncompleted—the present expedition is to complete this and also survey Ogaden and southern Dunkalia.

I. E. BUJOIU, mining engineer, has been appointed Minister of Commerce and Industry to the Roumanian government. He is a graduate of the Institute of Geology and a former official of the Steaua Romana and Petrosani oil companies. Since 1924 he has served as general manager of the Lupeni company, which exploits extensive coal mines in the Vallee du Jiu. In this capacity he showed great administrative ability and originality in the introduction of modern methods, aside from which he demonstrated a broad and enlightened social viewpoint in handling labor problems and improving living conditions and wages. His accession to office has inspired expectations of a new era in Roumanian national economy.

MAJOR FRANK HOLMES, who for many years was associated with the Eastern General Syndicate, London, is visiting New York. Major Holmes, who by profession is a mining engineer, became linked with the petroleum industry through having been granted an oil concession on the island of Bahrein, Iranian Gulf. This concession was acquired by Gulf Oil Corporation, later transferred to Standard Oil Company of California, and is now owned by Bahrein Petroleum Company which is controlled by California-Texas interests. Only developed during the last few years, Bahrein is proving to be one of the most valuable oil properties in the world. Recently 65 deg. A.P.I. gravity crude was discovered on the property between 4,150 and 4,535 ft.

Major Holmes also negotiated the Kuweit concession, now being developed jointly by Anglo-Iranian Oil Company, Ltd. and Gulf Oil Corporation, as well as having secured three other oil concessions in Arabia.

C. H. LIEB, who recently resigned from his position as president of Carter Oil Company, will now be located at Rockefeller Plaza, New York, in charge of production for Standard Oil Company of New Jersey.

J. A. Clark, general superintendent of production for Lago Petroleum Corporation at Maracaibo, in an informal photograph taken by World Petroleum while he was in Houston. Mr. Clark is due to return to Venezuela during January.

LAUNCELOT OWEN, geologist, sailed from London for Australia late in December, 1937, en route to Papua where he will be spending some time on geological survey for petroleum. Mr. Owen, who is a Welshman, is a capable horseman, driver and swimmer. He has conducted geological surveys for oil since 1915. His experience in many lands made him somewhat of a linguist—eight years in Colombia and three

Launcelot Owen in the Arab garb he adopted while in the Hejaz.

in Venezuela gave him a mastery of Spanish while considerable periods spent in the Western Pacific islands, Trinidad, France, Eastern Anatolia and Arabia have enabled him to acquire some knowledge of French, German, and a number of native dialects. Of late he has spent a year in the Near and Middle East, and while conducting geological work on the deserts of Western Saudi Arabia found it desirable to cultivate a magnificent beard which gained him great local renown. It appears that Arabs have considerable difficulty in producing a hairy growth on the face and that, inasmuch as the Prophet Mahomet possessed a beard, all bearded men are deeply revered.

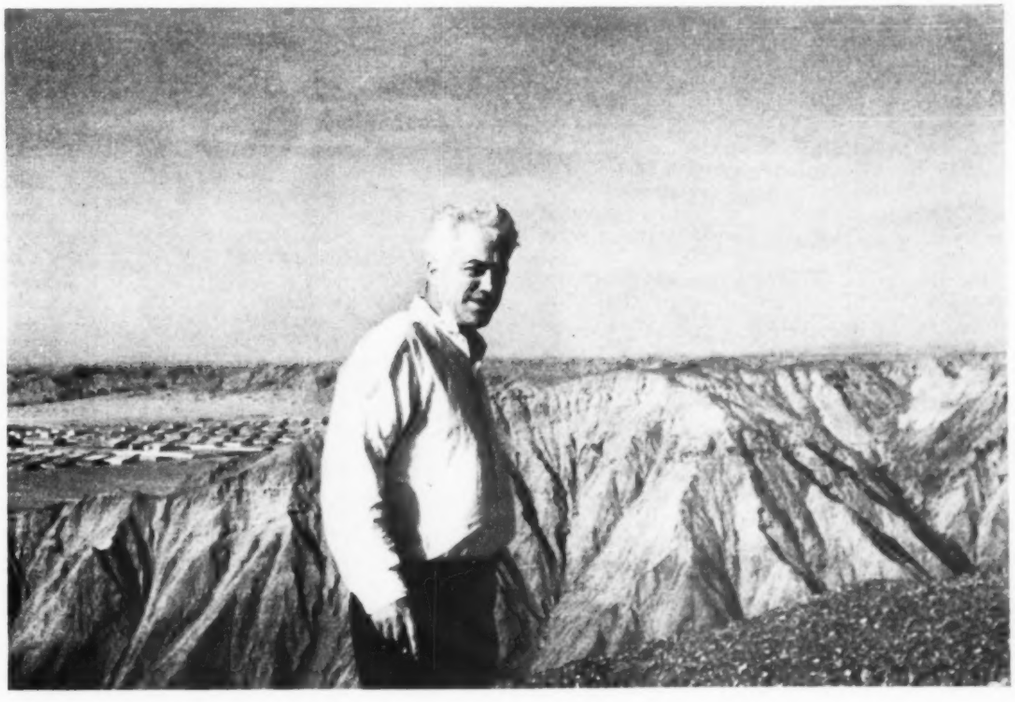
RALPH C. CHAMPLIN has been elected vice-president of Ethyl Export Corporation, foreign subsidiary of Ethyl Gasoline Corporation. Since joining the Ethyl organization early in 1937, Mr. Champlin has been chairman of the co-ordinating committee.

ALBERT WRIGHT, for more than 11 years with the Venezuela subsidiary of Gulf Oil Corporation, has been appointed general superintendent of Amiranian Oil Company. His office in New York will be at 39 Broadway.

A. C. CORNISH, assistant general manager of the eastern sales division of Standard-Vacuum Corporation at Nanking, and J. V. PICKERING, of the marketing department, were among the survivors of the attack on the tankers MEIAN, MEIHSIA and MEIPING. The three vessels were fired on by Japanese bombers and pursuit planes when nearby the stricken gunboat PANAY, some 27 miles above Nanking in the Yangtse River. A general evacuation of employees from the besieged area was under way, and particularly heavy casualties were effected among the Chinese staff.

Dr. E. H. Leslie

DR. E. H. LESLIE has joined the technical staff of Blaw-Knox Company and will supervise the design and fabrication of operating units for the oil refining and chemical industries. Dr. Leslie is best known for his work as consulting engineer and for his operation, since 1923, of the Leslie Laboratories at Ann Arbor, Michigan. He has been influential in the application of advanced chemical engineering to the problems of the chemical, petroleum refining and processing industries in general.



O. Desmond Boggs, posed against a natural background —Negritos oilfield, Talara, Peru—by Miss E. Phyllis Snider during her last visit. Mr. Boggs is chief geologist for International Petroleum Company and has been active in Ecuador and Peru for 18 years. Before he originally went to South America he did geological work in Alberta.

WORLD PETROLEUM ABSTRACTS

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing With Technical and Economic Aspects of the Petroleum Industry. Edited by Dr. O. W. Willcox

GEOLOGY

Use of Mechanical Sand Analyses for Correlation Purposes—I. I. Gardescu and M. H. Billings, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 21 (1937), No. 10, pp. 1311-1332.

In place of the usual methods of recording the data obtained by mechanical analyses and routine paleontological data a new method has been developed. In this method the sand is separated into a number of screen sizes from 20 to through 200 mesh, and each fraction is scrutinized under the microscope for lithological and paleontological characters; the results are recorded on transparent cards, which are arranged in series corresponding to the log of the wells. This has allowed of showing the relations between sand zones and the drawing of accurate contour maps. When so arranged detailed information of the deposition cycle within the sand body is obtained, even to the extent of establishing the geological history of the lower Miocene.

Sedimentation in Barred Basins, and Source Rocks of Oil—W. G. Woolnough in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 21 (1937), No. 9, pp. 1101-1157.

While the doctrine of uniformity must always form the basis of geological theory, it is necessary to admit that phenomena have occurred during geological time which have not been observed at all, or not in their entirety, during the very limited period of modern scientific investigation.

Reasons are given for the belief that major coal measures, major primary salt deposits, major fresh-water series of sediments, and source rocks of oil deposits are not now being deposited anywhere on the earth.

No continent-wide peneplanation of advanced maturity, comparable, for example, with the Middle Tertiary peneplanation of Australia, can be recognized at the present day. It is believed that the present is largely a period of orogeny rather than of peneplanation.

The main thesis of this paper is an amplification of the Bar Theory of Ochsenius. It is suggested that when all implications of this theory are considered, the possibility is indicated of existence in the geological past of barred basins of dimensions and characters entirely unrepresented at the present day.

Reasons are given for associating barred basins chiefly with maturity of peneplanation. Climatic factors are considered and it is concluded that humidity favors development of lacustrine conditions, of coal, boghead, and oil shale; while aridity controls formation of black shales, source rocks of oil, and ultimately salt deposits. Certain characteristics are common to all such deposits.

The occurrence of unbalanced planktonic assemblages of fossils, generally erroneously interpreted as indicating pelagic conditions, is shown to be compatible with deposition in barred basins. Fineness of texture and lamination, blackness of shale deposits, high organic content, pyritization, and composition of oilfield waters are believed to be due to barred-basin environment and not to excessive depth of water.

The suggestion is put forward, that certain lithological characters and structural features may be genetically associated with such depositional environments. Amongst these may be mentioned concretionary structure, cone-in-cone, barren argillaceous limestones, and organic siliceous cherts, particularly if dark in color.

As possible examples of deposits of barred basins are cited the saline formations of New Mexico, Irwin River basin (Western Australia), shoestring sands of Kansas and Oklahoma, Cretaceous limestones of Venezuela, Yates pool (Texas), some of the formations of southern California, and black shale deposits of New York and elsewhere.

Geological Significance of a Geothermal Gradient Curve—Walter B. Lang, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 21 (1937), No. 9, pp. 1193-1205.

The Getty-Dooley well No. 7 was drilled in Eddy County, New Mexico, to a depth of 6,683 ft. and passed through a thick section of Permian rocks, including the Rustler, Salado, Carlsbad, Capitan, Delaware Mountain, and into the top of the Bone Spring limestone. This stratigraphic section is divisible into three lithologic units: the Rustler-Salado, the Carlsbad-Capitan, and the Delaware Mountain unit. The subnormal geothermal-gradient curve for this well is also divisible into three parts and these subordinate gradients coincide with the lithologic divisions. Other possible factors that might cause the fundamental variations in the geothermal-gradient curve, such as water, heat reactions from solution, igneous intrusions, and radioactivity, are found wanting to explain the character of the curve. The radioactive heat of potassium is also found insufficient to affect the gradients in the Permian basin. It is therefore concluded that this subnormal geothermal-gradient curve owes its form to the different conductivities of the successive layers of rocks.

Application of X-Ray Crystal Analysis to a Problem of Petroleum Geology—D. H. Reynolds, Eldon A. Means and Lindsey G. Morgan, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 21 (1937) No. 10, pp. 1333-1339.

The definite identification of the exact geological stratum from which a drill sample originates presents a problem which has been only partly solved by microscopic examination and chemical analysis.

Although these have been indispensable in directing drill operations in the past and will certainly remain so in the future, a sure and unquestionable means of mineralogical analysis of finely divided specimens and complex mixtures would be welcomed by geologists as an immensely valuable aid in their work. Such a method is to be found in the powder method of crystal analysis by x-ray diffraction.

The pertinent facts concerning the use of x-ray diffraction for mineralogical analysis are summarized in the following statements.

1. Each chemical compound, or distinct mineral when pulverized and placed in the path of a monochromatic pencil of x-rays, gives rise to a diffraction pattern, which is unique for that substance. This pattern may be recorded photographically.
2. The same substance invariably produces the same diffraction pattern, which is different from that obtainable from any other substance.
3. Different polymorphic forms of the same compound, or mineral, show different x-ray diffraction patterns, and so can be distinguished with certainty. Thus flint, which is crypto-crystalline quartz, shows the same pattern as a powder prepared from a large single crystal of alpha-quartz, but cristobalite and tridymite give patterns different from alpha-quartz, and different from each other.
4. For a mixture of minerals, each mineral present gives its own pattern, regardless of the other constituents and the resulting pattern is made up of the superimposed patterns of all the individual minerals present.
5. By comparing the pattern for a mixture with those for pure minerals it is a simple matter to identify beyond any reasonable doubt the minerals present, and, what is of almost equal importance, it is easy to make an estimate of its relative abundance. The only limitation is that a particular mineral should be present to the extent of one or two percent.

Water Insoluble Residues in Rock Salt of Louisiana Salt Plugs—Ralph E. Taylor, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 21 (1937), No. 10, pp. 1268-1310.

The concept that rock salt of the Gulf Coast salt plugs is virtually pure halite has been established on surprisingly meager data, and is contrary to what should be expected in the light of what is known of salt deposits in other parts of the world. The composition of Gulf Coast rock salt has direct bearing on the origin of cap rock.

Although data are available from only about 30 of a total of 134 localities, it is evident that the rock salt of the Gulf Coast salt plugs is fully as complex in character as that of other regions. The salt plugs contain a complex assemblage of water-insoluble minerals and rock inclusions, soluble salts other than halite, gases of different composition, and oil. An average for the total amount of water insolubles present in the rock salt from Gulf Coast salt plugs is difficult to give because of the great variability of different deposits. Hanna's figure of 5-10 percent (1934) does not seem too high when all of the contributing factors are taken into consideration, and this figure is similar to those given by Bretnutz, Lachmann, and others for the German salt plugs.

Comparisons indicate that the mineral assemblage of water-insoluble residues of the Gulf Coast rock salt is different from that of the Silurian and Permian deposits of North America. The striking similarity of all the Gulf Coast residues suggests that further comparisons might afford clues to the age of the salt. Data on the residue in the rock salt of Lower Cretaceous age at the Chittim locality, Maverick County, Texas, are particularly desirable. Although it might not be possible to establish a definite cor-

relation on this basis, no line of evidence which might aid in the solution of this difficult problem should be overlooked.

The dominant feature of the water-insoluble residues is the high percentage of anhydrite grains. In addition to anhydrite, perfect rhombohedral crystals of dolomite containing distinctive nuclei, crystals, and nuclei-bearing rosettes of quartz, and pyrite crystals, typify the water-insoluble residues of the rock salt of the Gulf Coast salt plugs. All of the residues appear to contain these minerals, and some have in addition distinctive minerals which set them apart from the others. The sands of the inclusions differ sufficiently from sands of the Gulf Coast Tertiary to permit them to be classified as distinctive.

It seems reasonable to conclude, therefore, that if this same assemblage of water-insoluble minerals which characterizes the salt plugs occurs in the associated cap rock, definite evidence indicating the formation of cap rock through accumulation of water-insolubles in the salt will have been established.

Microscopical Examination of Crude Petroleum—J. McConnell Sanders, in JOUR. INST. PETROLEUM TECHNOLOGISTS, vol. 23 (1937), No. 167, pp. 525-573.

The modern acceptance of the theory that petroleum owes its origin to the low temperature decomposition of organic matter has led the author to investigate the possibility of finding in crude oil, vestiges of those organized bodies which gave birth to it.

It was thought that, as in the case of coal, some portions of the primordial material might have been preserved, either because they were inherently resistant to decay, or because of the great preservative power of the petroleum itself, as evidenced by the results of recent investigations in other directions.

The object of the present paper is to give an account of the special apparatus and technique developed by the author for this type of investigation, and to record the results obtained by applying the method to a large number of crude oil samples, chiefly from Mexican and Roumanian fields.

The significance of the results and their bearing on problems related to the genesis of oil are discussed, as well as the possibility of utilizing the method for correlation purposes and increasing our knowledge of ancient forms of life.

In addition, some account is given of the chemical evidence which has supplemented the microscopical investigations carried out by the author.

The list of the organic remains and other objects found by the author in his petroleum samples is of surprising length. These include many kinds of diatoms, radiolaria, petrified wood, crustacea, insect remains, feather barbules, cedular organisms, soare coats, algae remains, fungal hyphae, plant hairs, resin droplets, lignitic fragments, etc. These objects are pictured in numerous excellent plates, and there is evidently opened up a wide field for correlation research, as well as for further study on the origin of petroleum.

A Method of Determining Porosity; a List of Porosities of Oil Sands—D. B. Taliaferro, Jr., I. W. Johnson, and E. J. Dewees, in BUREAU OF MINES DEPT. OF INVESTIGATIONS, R. I. 3352 (Sept. 1937); 24 pages.

Information regarding the pores or voids in reservoir rocks is vitally important in the scientific extraction of petroleum from natural underground reservoirs, and petroleum technologists concerned with subsurface conditions have devised various methods that give reasonably accurate information as to the porosities of oil and gas-bearing sands. In this work, several investigators have made use of the experience of the ceramic and other industries.

The method of determining the effective porosity of oil sands described in this report falls within the general classification of gas-expansion methods.

The volume of the pores in the specimen is determined by subtracting the volume of the sand grains from the bulk volume of the specimen. The volume of the sand grains is determined by noting the reduction of void space in a vessel or bomb of known volume when the specimen is placed in it. The volume of space in the bomb not occupied by the sand grains of a specimen is determined by introducing compressed gas in the bomb, observing the pressure in the bomb, and later releasing the compressed gas and measuring accurately its volume at atmospheric pressure. With the above data, the volume of the void space in the bomb is calculated by use of the pressure-volume relationship expressed by Boyle's law, with a correction factor for the deviation from Boyle's law at the pr ssure and temperature of the test. When there is a difference in temperature between the compressed gas in the bomb and its expanded volume as measured in the burette, the expanded volume is converted to a volume at the temperature of the gas in the bomb by application of the temperature-volume relationship expressed by Charles' law. The volume of the empty bomb is determined in the same manner. The difference between the volume of the empty bomb and the volume of void space in the bomb with the test specimen in it gives the volume of the sand grains.

The total or bulk volume of the specimen is determined with a pycnometer using mercury. The difference between the bulk volume and the volume of the grains gives the volume of voids in the specimen, and this volume divided by the bulk volume multiplied by 100 gives the porosity in percent.

Probably the greatest advantage of the method is that the test specimen is not affected in any way by the determination and is available for other tests; or, if it is desired, check porosity determinations may be made. Very accurate results may be obtained, although the time required for a determination is not excessive.

The porosity ranges of a large number of oil sands from different parts of the United States are given.

Stratigraphy Versus Structure in the Rocky Mountain Region—Ross L. Heaton, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol 21 (1937), No. 10, pp. 1241-1267.

In the Rocky Mountain region there are several oil and gas fields which owe their existence to factors other than anticlinal structure. Only two or three of them are of particular importance from the standpoint of total recovery but they are significant in that they suggest the possibility of finding other fields of equal or greater importance.

In view of this fact and having in view the necessity of maintaining an annual supply of more than 1,000,000,000 bbl. of oil, and further considering the fact that more than half the production of the 22 largest oil pools in the United States has been from stratigraphic traps, the author undertakes a study of the conditions under which stratigraphic oil pools may be formed.

The problem is approached from the standpoint of source rocks as well as reservoir rocks. Localities in which there are apparent relationships between petroliferous provinces and ancient geography are described by reference to generalized paleogeographic maps of the Rocky Mountain region from Pennsylvanian to Cretaceous time. The nature of the sediments and the conditions under which they were deposited were profoundly affected by ancient positive elements which are called the Ancestral Rockies.

Numerous instances of lenticular and wedging sand bodies are pointed out as having possibilities for the formation of stratigraphic traps on the flanks of major uplifts or in structural basins. A great deal of detailed stratigraphic work must supplement the present general knowledge.

The supply of oil in the last few years has been maintained largely by finding favorable structures by geophysical methods; such structures naturally attract the wildcatter. But the supply of favorable structures in the discovery of which geophysics has been a great success, will eventually be exhausted, and there is pressing need for development of a new technique that might lead to the discovery of pools other than those due to anticlinal structure.

DRILLING

Drilling Equipment Progress—Jos. Jensen, in PETROLEUM WORLD ANNUAL REVIEW, 1937, pp. 41-53.

The author reviews progress in oilfield drilling, with special reference to California. The list of advances as they apply in that state include the following:

Development of time-saving portable drilling equipment.

Substitution of other forms of power than steam for wells as deep as 7,000 feet.

Power directly connected to the rotary table, avoiding operating the main engine at a fraction of its capacity.

Substitution of wire line coring for full hole coring and use of electrical logging.

Application of electrical logging in cased wells.

A magnetic method of determining the original position of a core in the well.

A method of determining the dip of formations in the ground.

Saving of casing by cementing through perforations rather than below the primary cementing job of the well. This is done in strings of solid pipe properly cemented on bottom.

The use of bottom hole pressure bombs in connection with formation testers.

The introduction of brittle or soft material liners that can be drilled up as an aid to testing the productivity of portions of an oil zone.

Use of chemicals to break down mud sheaths in wells that have lost much of their original gas content, so that partly depleted oil sands may produce their oil.

Changing the method of drilling deep wells so that the hole is carried to the objective depth before any attempt is made to test the oil formations that have been encountered.

Improvements in casing by modifying the thread, eliminating collars, use of butt welding in order to shorten time of casing jobs.

The savings effected by these various means are reducing the cost of prospecting for new oilfields, a job that is becoming increasingly difficult.

Gravel-Packed Liners in Caving or Sandy Wells—T. P. Sanders, in OIL AND GAS JOUR., vol. 36 (1937), No. 22, p. 59.

In the San Joaquin Valley of California The Texas Corporation is completing all wells with slotted liners set in large-diameter holes, the space around the liners being filled with screened river gravel. While gravel packing of liners is not a new idea in the industry, its acceptance in this area as standard practice by a major company represents an important advancement in production technique.

It has long been the theory that a large-diameter hole in the productive strata would tend to increase productivity, while the use of gravel would prevent

caving. Gravel has been used in water wells for years, but its use in oil wells has been discouraged because of the difficulty of reaming out a large-diameter hole at great depths and of packing gravel around a liner in such a cavity. In the past few years several inconspicuous experiments of this kind have been made.

However, these attempts have not been eminently successful for want of a safe and convenient method of placing the gravel. By developing such a method The Texas Corporation has taken this type of completion out of the experimental stage.

In the first place, the hole is underreamed from a few feet below the shoe of the water string to the total depth allowed by economic considerations; 16 to 20-in. holes are mostly preferred. Best results have been obtained using screened gravel of ¼ to ⅜-in. mesh.

Three methods of placing the gravel around the liner in the reamed hole have been tried. First method was that of placing a measured quantity of gravel in the hole before running the liner. The liner was run with closed bottom and a sharp shoe, but it was found impossible to work it to the bottom of the well. On the next well a full string of pipe, with lower joints slotted, was run to the bottom. Light, viscous mud was pumped down the outside of the string, and gravel was added to the mud. The mud passed through the slots at the bottom of the pipe and returned to the surface, leaving the gravel in back of the pipe in the oil strata. The gravel was then washed with water. This method was successful, but since it required a full string of pipe a cheaper way was sought. As a result a practice was adopted whereby the liner could be run on the drill pipe and the gravel placed, as before, by reversed circulation.

Economy of Maintaining a Vertical Hole—S. A. Wallace, in PETR. ENGINEER, vol. 8 (1937), No. 13, pp. 186-189.

The advantages of completing a well with a straight bore are obvious; but the fact that greater speed and considerable economy frequently may accompany controlled vertical drilling is not so widely recognized. The measurement of the inclination of the hole at frequent intervals is necessary but the important factor in controlled vertical drilling is that the data procured by drift indications provide a means for increasing the efficiency of the drilling operations. Instruments now widely used on a rig for measuring the weight on the bit, the table speed, the mud-pump pressure, and the torque on the drill pipe all enable the driller to keep the hole very close to vertical through any formation, provided he knows what tendency there is for the bit to drift. The use of a drift-recording instrument run at proper interval keeps him advised of that tendency and allows him to straighten up any deviation before the hole has drifted so far off vertical as to require a plugging-back job.

The main advantage in measuring the inclination of a well at frequent intervals during drilling, however, is in obtaining accurate information from which to formulate the technique and methods to be used. To get full value from such measurements an instrument should be run that will give an immediate record of the inclination and provide the crew with a knowledge that will aid in keeping the well vertical.

In controlled-vertical drilling the maximum deviation allowed varies to a considerable extent with different companies. At the present time, however, the limit is less frequently set up to five degrees. Some operators feel that a three-degree limit results in faster drilling than does a higher allowable. The three-degree maximum seems to avoid plug-backs and other disdavantages and it is believed that it is more difficult to hold to four or five degrees than it is to hold to three. With rare exceptions in formation conditions it has been found that a well held to three degrees will bottom close to the vertical and in Kettleman Hills such wells are completed within 100 ft. of the point directly below the mouth of the well. When the hole is not held to close limitations there will be large changes in direction.

A Steam Drilling Rig that Approaches Power Plant Efficiency—M. L. Cashion, in PETR. ENGINEER, vol. 8 (1937), No. 13, pp. 41-43.

A Gulf Oil Company drilling rig working on a deep test on the Louisiana shore has a 350 h.p. steam plant that is described as the most efficient and economical rig that has yet been designed. The outfit is fully described; the efficiency and economy are ascribed to the following six features: (1), automatic control; (2), dutch ovens under boilers and superheater; (3), fully insulated boilers and steam lines; (4), superheated steam; (5), reciprocating engines operated with cut-off control; (6), condenser, which reduces the back pressure on the engines and returns heat and clean water to the boilers.

Determination of Fluid Level in Oil Wells by the Pressure-Wave Echo Method—C. P. Walker in TRANS. AM. INST. MINING AND METALLURGICAL ENGINEERS. (Petrol. Development & Technology), vol. 123 (1937).

A new method and apparatus for determining fluid levels and fluid pressures in oil wells is described. The principle of operation is the same as that used in the sound method of range finding in artillery work, the chief difference being that a single-cycle long inaudible wave is employed instead of short sound waves. Methods of determining the rate at which the wave travels in the well are described. In one of these methods all tubing collars exposed above the fluid surface are photographed and the joints from the casing head to the fluid surface counted on the depthograph chart.

This method of determining fluid levels is employed principally in wells equipped with mechanical pumps. Well tests are made without interrupting production. Fluid densities, a knowledge of which is valuable in the solution of difficult pumping problems, are readily determined.

New Radial Type of Deep-Well Pump—Paul Reed, in OIL & GAS JOUR., vol. 36 (1937), No. 23, pp. 44-46.

A new pumping unit is described which applies a hydraulic ram to operating conventional subsurface sucker-rod equipment. The device is unique in principle in regard to the manner of lifting and balancing the load. In addition, the design includes a pump for handling the actuating fluid, resembling in general appearance a radial motor on an airplane. This in itself is a distinct innovation in the field of mechanical invention.

By combining pneumatic counterbalancing with hydraulic lift, a long stroke of 15 ft. at the slow rate of seven strokes per minute is had without shocks at reversals. This equipment, known as the hydraulic pumper, invented and developed by William E. Hubbard, is especially adapted to very deep wells and is designed to get the advantages to be had in using hydraulic propulsion as a means for obtaining long strokes. The equipment is centrally placed over the well and functions without using cranks, eccentrics, balance or bandwheels.

The main features of the hydraulic pumper as described by the inventor are as follows: In principle the device balances the entire weight of the rods, half the weight of the oil lifted, and half the friction and acceleration loads. This is done by means of compressed air which is enclosed in a pressure vessel and this balancing medium is directly placed over the actuating fluid. The additional energy to lift the remaining load consisting of half the oil load, friction and acceleration is supplied by a reciprocating displacement pump radially arranged. The pump is driven by any form of rotating prime mover.

A unit installed by the Skelly Oil Company in the Polo (Okla.) field has shown satisfactory operation which has been especially marked by an absence of sucker rod breakage, due to elimination of shocks at reversals.

Gas-Oil Ratio Control in Flowing Wells—R. J. Sullivan, before AM. PETROLEUM INSTITUTE, Chicago, November, 1937.

Gas conservation in relation to efficient production of oil is steadily receiving greater practical attention, becoming of more direct interest. Gas-oil ratio control is essentially a problem of coping with free gas and, therefore, of attempting to retain free gas in the reservoir while continuing to extract satisfactory volumes of oil. This demands control of the differential pressures responsible for delivery of oil and gas by the pay formation to the well itself.

Well characteristics referring gas-oil ratio to production rate as a convenient indicator of subsurface flow pressure are presented from several gas-drive pools. Their behavior in the face of gas-cap encroachment is discussed and seen to be reflective of pool behavior. In amplifying the central proposition that all methods of contending with high-pressure free gas are analyzable in terms of differential-flow-pressure adjustment, the uses of fluid-level regulation, tubing design, sub-surface choking, intermittent flow, acid treatment, and mechanical exclusion of gas from the well are taken up.

Studies of well behavior after application of a positive gas shut-off to the sand face, while illustrating the possibilities of intermittent flow, corroborate conclusions drawn from their open-hole behavior. They also strongly suggest the future contingencies to be considered by preventive methods of ratio control.

Crude Oil Desalting—Gustav Egloff, E. F. Nelson, C. D. Maxutov and Charles Wirth III, before AM. INST. MINING AND MECHANICAL ENGINEERS, Oklahoma City, October, 1937; OIL & GAS JOUR., vol. 36, Nos. 22 and 23.

The treatment of emulsified crude oils has been a problem for years in the petroleum industry. Until comparatively recently various methods of settling with and without chemicals have been used with indifferent success. With the advent of acidizing wells, emulsified crudes have been produced which add considerably to the need for improved methods of treatment. The presence of large quantities of salts in the oils from acidized wells has presented new problems to the industry.

The use of hydrochloric acid in the well treatments has caused the formation of sodium magnesium, and calcium chlorides by interaction with the limestones. These salts dissolve readily in the water normally present in the oil, and they are therefore incorporated in the emulsified oil. The crystalline salts which have also been found in the oil are prevented from settling by protective films such as asphalt, resins, and petrolatum. The salts may be present in crude oil in amounts ranging from a few pounds to over 750 lb. per 1,000 bbl. of oil.

Transportation of these crude oils through pipelines has led to erosive and corrosive effects which are a tremendous cost to the petroleum industry. If the crude oils were treated at the producing wells to remove the salts and water, an appreciable savings would be possible. The treatment would not be

difficult since it has been found that these oils are more readily treated as they are produced than after the aging and more stable emulsification that occurs before they reach the refinery. Since great costs are involved in the use of these salty crudes at the refinery, those treated oils which would be essentially free of salts would naturally command a premium.

Various methods of dehydrating and desalting crude oils employ heat and pressure, chemical or electrical action, centrifugalation, or filtration. The authors made a laboratory study of methods which employ heat and pressure. They found that:

The effects of temperature and percent water added on salt removal are very closely interwoven. When either factor is increased the salt content of the oil is decreased. Thus, to obtain a desired degree of desalting the temperature may be increased and the water decreased or vice versa. The optimum percent of water added is 10 percent by volume of oil, and the optimum temperature is 400 deg. F. That is, if a definite weight of salt is removed at 400 deg. F. and 10 percent water, much higher temperatures must be used with 3 percent of water to obtain the same desalting effect.

They then proceed to a study of other methods, including those that employ chemicals; these may differ in detail, but they all involve the principle of adding water and settling at a high temperature. Crude oils may be desalted to an extent of 99.7 percent by centrifugaling, but the operation may not be economical.

Although filtration as a method of salt removal has not assumed commercial proportions, investigative work has indicated its feasibility. Satisfactory mechanical design of the filter equipment is at present the primary and perhaps only limitation. It is probable that a suitable method will eventually be realized and this procedure will without doubt employ a filter-aid. Without a filter-aid the impurities and salt in the oil will either pass through the filter cloth or completely clog and seal the flow channels.

In an experiment with a small vacuum precoat filter, several tests were conducted to determine the salt removal and the filtration rates. A Mid-Continent topped crude oil containing approximately 100 lb. of salt per 1,000 bbl. was used. The oil was maintained at a temperature of 130 deg. to 290 deg. F. in the several test runs.

The salts obtained showed a removal of salt to 14 lb. per 1,000 bbl. Based upon a rate of 24 gal. per sq. ft. per hour a filter of approximately 80 sq. ft. should filter 1,000 bbl. in 24 hours. This size installation is not unreasonable for commercial operation.

Electric Power Required for Pumping Oil Wells—W. H. Stueve, in PETR. ENGINEER, vol. 8 (1937), No. 13, pp. 48-50.

How much electric power is required to pump oil wells? This is a question that has been asked many times. This interest doubtless is due to the great number of electric-motor-operated pumps that have been installed in the oilfields in recent years.

The fact is that in the face of free gas for fuel—usually conveniently available on oil leases—cheap operating labor, and improvements in prime movers, the use of electric power has gone forward steadily, and today it is found to be gaining in favor among operators, but the choice of the manner in which the electric power is procured is dependent upon a great variety of economic situations.

Theoretical data on pumping energy are available in great quantities, but positive factual information best can be obtained from electric-metered operations.

The author has made a study of a large number of wells. This study covers the lifting of 1,486,814 bbl. of fluid from all depths and the total electric energy consumed is 1,977,869 k.w.-hr., or an average of 1.32 k.w.-hr. per bbl. of fluid, or 5.85 k.w.-hr. per bbl. of oil lifted. With the possibility that electric energy could be purchased in most instances for one cent per k.w.-hr., the total lifting costs would be only about four percent of the total value of the product, which compares favorably with most industries of a similar nature.

Conditions will vary from well to well and district to district, so the author provides tables and graphs wherein depth in feet is shown against electric energy expressed in k.w.-hr. per bbl. of fluid.

It is concluded that the best average pumping efficiency obtainable from beam pumps is approximately 35 percent. The efficiency of central power pumping is slightly higher but apparently it can not be improved upon; and this seems to hold true also for the centrifugal bottom-hole pump. The hydraulic-actuated pump has the greatest efficiency of any studied, but its limitations in capacity preclude its use when volumes greater than 400 to 700 bbl. from depths of 6500 ft. are considered.

NATURAL GAS

Soap Solution for Lubricating Gas Compressors—Mitchell Tucker, in OIL AND GAS JOUR., vol. 36 (1937), No. 25, pp. 46-49.

Soap solution lubrication has been employed successfully for the past year by United Gas Public Service Company on the gas compression side of its 8,000-hp. two-stage gas compression station in the Rodessa field, handling over-saturated gas at high temperatures, by the use of sight feed lubricators.

This station collects low-pressure wet gas from oil and gas separators at 50 lb. pressure and compresses it to a maximum of about 450 lb. for the natural gasoline plant, which has a capacity of 140,000,000 cu. ft. of gas a day.

Lubricating oil for the compression side of these units would be quickly cut out and rendered ineffective in the presence of this over-saturated gas, particularly at high temperatures. The United Gas Public Service Co. is successfully employing a soap lubricating system of its own design which has adequately and economically handled the job since its construction in the summer of 1936.

The lubricant consists of a vegetable oil soap dissolved in an 80-gal. tank in the ratio of one part of soap to eight parts of water. About one quart of lubricant every 16 hours is required on each side of each 1,000 h.p. two stage compression unit. The lubricant is said to be insoluble in gasoline or wet gas. It is noncorrosive and does not cut and wash out the compression cylinders. Examination of the inner cylinder walls shows that a thick film of high strength is deposited. No evidence of carbon deposition or wall wear has been noted after one year's operation.

Low Temperature Fractionation of Gases, Vapors and Liquids—F. N. Laird, in OIL & GAS JOUR., vol. 36 (1937), No. 24, pp. 58-59, 62, 65.

The utility of the complicated low temperature analysis procedure has been largely limited to the analysis of occasional samples, or the analysis of samples for research, development or survey work. In spite of its usefulness the method has never been applied to the broad field of general plant and field testing, now covered by the charcoal test.

The idea occurred to the writer that if low temperature analysis could be conducted in glass, then why not in metal? If the method could be made to work in metal, then why could it not be simplified through the elimination of many working parts necessary to the glass form?

Acting on this idea a metal fractionating apparatus was designed from which all glass parts are elimiminated except the kettle and butane condensation bulb. The final apparatus consists essentially of a gas dehydrating unit, graduated condensing and distilling kettle, fractionating column, condenser section, pressure gauge, rate control valve and rate manometer, butane condensation bulb, displacement meter capable of measuring under vacuum, and a vacuum pump. All of these items are assembled of materials lending ready portability to the completed unit. The dimensions of the various parts, in relation to one another, are very important if accurate results are to be obtained.

Solid carbon dioxide may be used as the cooling agent. The problem of taking, transporting and transferring samples is solved by taking the sample directly into the apparatus. One unit can survey a complete gasoline plant in eight to 24 hours.

Using a formula developed by W. J. Murray for calculating the amount of any hydrocarbon which will condense under any pressure and temperature, the author has drawn standard curves by which to correct the amounts of each component found by the analysis. This formula is:

$$C_1 = \frac{LC}{100\frac{P_c}{P} + L\left(1 - \frac{P_c}{P}\right)}$$

Where: C_1 = mols of component in liquid after condensation.
C = mols of component in gas.
P_c = absolute vapor pressure of pure component at temperature of condensation.
P = total pressure on system.
L = total mols of liquid after condensation.

With this formula a series of calculations were made to find how much of each component will condense at —110 deg. F. (sublimation temperature of carbon dioxide), and pressures from 0 to 32 lb., absolute. These calculations were carried out for propane, isobutane, butane, isopentane and pentane.

In practice not all the isobutane and heavier gases are condensed, but the curves show what percentage is actually condensed, which is the purpose of the analysis.

TRANSPORTATION

Cathodic Protection for Pipelines Without Fuel Cost—Dave Harrell, in PETROL. ENG., vol. 9 (1937) No. 1, pp. 117-120.

For the past three months the Houston Pipe Line Co. has been experimenting with a small cathodic unit powered by a rotary engine which is made to run on the pressure drop around a large gas regulator at a point of high delivery, whereby several horsepower are obtained without consuming any gas, and converting some of the work done by the regulator into useful energy. The electric current produced by this engine was used to furnish cathodic protection to a gas line, and although the unit is still in process of being perfected, it appears to have a promise of giving ample protection against corrosion at no fuel cost whatever.

Heat Conductivity of Soil and Heat Losses from Heated Pipelines—C. N. Johnston, in PETROL. ENG., vol. 9 (1937) No. 1, pp. 41-48.

Heat loss is a determining factor in pipeline design, because the temperature of the oil being transported has a direct influence on its viscosity and hence on the power required to force it through the line. It is perfectly well known to every pipeline operator that heat loss from an oil is influenced by

the prevailing weather conditions, but it has not been so obvious that even under ideal summer conditions, comparable sections of pipeline are affected by wide differences in rate of heat loss. The author has made investigations that bring out the effects of the heat conductivities of the soils in which the pipe is laid; some soils have greater thermal conductivities than others. In the first place, the heat conductivity of a soil is in direct relation to its water holding capacity; that is, to its free pore space. On the other hand when a very porous soil is dry it is a bad conductor of heat, due to the numerous air pockets in the pores. So the same soil may cause large or small losses of heat according to moisture conditions. The denser the dry soil the greater the conductivity because such soils have fewer voids to hold air, which is a bad conductor. On the other hand again, a dense soil will hold the least water, so its heat conductivity is not so greatly affected by a wet condition.

All in all the matter is a complex one, but the author reaches the conclusion that a heat conductivity survey of the soil in which a pipeline is laid should produce a line whose design features will match operating characteristics more closely than has been possible in the past, and an appropriate procedure is outlined.

Heat Utilization in Dehydrator Plant—R. W. French, before AM. INST. MINING AND METALLURGICAL ENGINEERS, Petrol. Div. Los Angeles, Oct. 1937; OIL WEEKLY, vol. 87, No. 5.

The necessity for heating most crude oil emulsions during treatment to meet pipeline specifications provides a profitable setting for the application of efficient heat exchange equipment. Centering about the use of a direct gas-fired heater of the pipe still type, the proper exchange of heat between emulsion, waste water, clean oil, exhaust steam, and cooling water may achieve considerable fuel economy as well as efficient operation. The author describes a satisfactory installation.

Tangible improvements in operating effectiveness of the new plant under discussion are twofold. The average cut of the cleaned oil has been reduced from 1.75 to 0.5 percent. The gravity has been raised to such an extent that the average price per barrel received for all lease oil is more than eight mils higher, corresponding to a net increase in revenue of $980 monthly. And additional gravity improvement is expected to follow the early installation of facilities which will further cool the cleaned oil through the use of sea water. The economies described in the foregoing paragraphs may be summarized for the subject plant as follows:

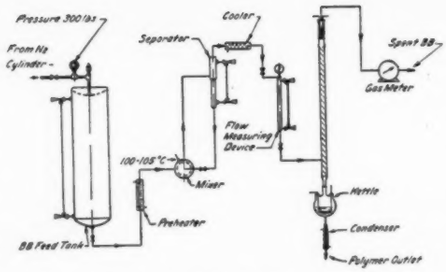
1. Installation saving, compared to live-steam unit, of $5,180.
2. Fuel economy of 49 percent.
3. Maintenance expense reduction of 5 percent.
4. Net gain from improved quality of oil of $980 monthly.

These savings acted to lower unit treating cost 10 percent, and when combined with the revenue increase will return the cost of the plant reconstruction in seventeen months.

REFINING

Catalytic Polymerization of Butylenes by Sulphuric Acid—S. H. McAllister, before AM. PETROLEUM INSTITUTE, Chicago, November, 1937.

Continued improvements in automobile and airplane engines have called for special fuels of high octane number. These fuels are obtained by the polymerization of the lower olefins found in Dubbs pressure distillate. The Shell companies have been producing iso-octane from isobutylene in commercial



Experimental Hot-Acid Polymerization Plant.

scale for some time. Increasing demands for fuel having an octane number of 97 or better have led to the development of a modification of the original isooctane process. This method uses hot sulphuric acid as a catalyst; a portion of the normal butylenes is polymerized along with the isobutylene.

Almost double the yield of octenes is obtained from the same fuel stock and these, when hydrogenated, have an octane number nearly equivalent to that of pure isooctane. The process is in full commercial operation.

Using the mixer type of reactor, the effect of the several variables in the reaction was experimentally determined. It was found that:

1. The effects of temperature and acid strength are closely interrelated. Acids ranging between 63 to 72 percent by weight can be used at temperatures from 75 to 100 deg. C., the higher acid strength being used with the lower temperatures. It is preferable not to use stronger acids or higher temperatures, as formation of sulphur dioxide or sulphate ester will then become appreciable. Lower acid strengths lead to longer contact times and enhanced corrosion of the reactor system. However, within the above range, considerable flexibility is allowed without appreciably altering the results which are obtained.
2. The size of the acid phase also affects the reaction. The larger the acid phase, the more rapid is the reaction. However, for commercial operation in the above limitations of acid and temperature, there seems to be little advantage in using more than a 1: 1 or up to 2: 1 ratio of acid to hydrocarbon.
3. The effect of increasing contact time is to increase the amount of reaction until an equal quantity of isobutylene and normal butylene is reacted. Above this, large increases in contact time increase the yields only slightly.

By using combinations of these variables, it is possible to react 90 percent of the isobutylene and 10 percent of the normal butylene, or completely to react the isobutylene and an equal quantity of normal butylenes. This flexibility is an advantage when volatility requirements in winter call for more butanes and butylenes.

French Refinery Experience with Corrosion—Chieze, in IND. PETROLE, vol. 5 (1937), No. 9, pp. 31-34.

Detailed studies of corrosion in two French refineries are reported. One of these is the Raffinerie de Normandie, which for a year operated on East Texas and Roumanian crudes which produced no corrosion worthy of note; then operations were changed to Mesopotamian crude. The Raffinerie de Provence has been operating on Mesopotamian crude practically continuously since its inauguration in 1935. In checking up on corrosion extensive inspections and measurements were made at frequent intervals.

The principal results of these studies are, first, a demonstration of the futility of attempting to control corrosion by the use of caustic soda, due to the necessary introduction of water and the hydrolysis of sodium sulphide in the flash tower (apparently no experiments were made with ammonia—Ed.); and second, a demonstration of the high utility of special alloy steels. Chrome molybdenum steels (4 to 6 percent chromium and 0.5 percent of molybdenum) have given distinguished service as furnace tubes.

With these tubes corrosion has been at the rate of 0.9 to 1.2 millimeters per year, whereas with the soft steel tubes previously used the rate was 2.1 to 2.6 millimeters per year. Besides, the alloy steels have a much higher softening point with considerably less chance of sagging and blow-outs; no blow-outs at all were had with chrome nickel tubes of the type 18/8, which have still higher softening points. These same 18/8 chrome nickel steels have been used for the tubes through which the charge is flashed out of the reaction chamber; whereas at this point the corrosion of soft steel tubes was at the rate of 5 millimeters a year, the 18/8 steel tubes have shown no decrease in thickness since July, 1935.

The Howard Process Applied to Treatment of Refinery Gasoline—Emby Kaye, in OIL & GAS JOUR., vol. 36 (1937), No. 24, pp. 50-52.

In this new process stabilized gasoline, with propane, hydrogen sulphide, and excess butane eliminated by fractionation, and to which chlorine has been added, is vaporized in a fractionating column and the vapors passed into a contact tower below a bed of oxidized zinc, like zinc oxide or zinc oxychloride, which is dispersed through the tower in a solid binder of one of various possible kinds. The vapors issuing from the tower are then fractionated and the overhead condensed as finished gasoline. Polymers from the final fractionator and from the bottom of the contact tower are fed into the stripper tower with the raw gasoline and ultimately the bottoms from this tower, containing all of the stripped polymers, are diverted to fuel oil or to other operations, according as is the usual practice in the particular plant.

The author has studied this process in a pilot plant, and finds satisfactory results in the matters of color, odor, doctor test, gum and storage tests, sulphur removal (varying from 15 to 80 percent), octane preservation and lead susceptibility, particularly the latter, which indicates almost incredible savings in the successful treatment of straight run gasolines of 45 to 50 octane.

The pilot plant results indicate a long life for the oxidized zinc, and it has been found that the chemical may be regenerated by turning steam into the bed. The life of the chemical bed will determine the ultimate cost of the process for the several services which it gives, and this will be determined in a commercial plant which is now starting operations.

Extraction of Salts from Refinery Stocks by the Electrical Process—T. N. St. Hill and G. B. Hanson, in REFINER, vol. 16 (1937), No. 10, pp. 466-469.

Although the salt problem is not a new one to oil refiners, it has, within the last few years, become a factor of major importance in refinery operations. This enlarged importance of the salt nuisance is due in large measure to the higher temperatures and pressures employed in cracking operations, and to the increased use of acidizing in oil production.

Salt troubles are chiefly due to mechanical stoppage of and corrosion of equipment. The severity of corrosion is proportional to the quantity of salt in the crude, and the rate of corrosion is proportional to the amount of hydrolyzable chlorides (principally magnesium chloride).

The rise of this kind of refinery trouble has naturally brought the question of counter measures

to the fore. Washing with water has been tried and found wanting because, as the authors state, the best washing processes have a maximum efficiency of only 70 percent; this is unsatisfactory, because even small amounts of salt may cause a lot of trouble.

The final answer now appears to be the electrical process, which is the subject of issued and pending patents. In its present form the process is essentially as follows:

(1) Fresh water is added to the oil stream, the oil and water being passed through a mixing device. This is usually done after the oil has passed through the first heat exchanger at temperatures ranging between 140 deg. and 190 deg. F. The best results have been obtained by pumping the required amount of water (usually between 5 and 50 percent by volume) into the oil stream and then passing the stream through a properly controlled mixing valve. The most desirable pressure drop across such a mixing valve varies with different oils. The control of the mixing step is one of the most important phases of the process and must be properly correlated with the subsequent action which takes place in the electric field.

(2) The mixture after passing into the electric treater is subjected to the action of a high voltage electric field which serves to treat it and coalesce the water particles until they become large enough to gravitate from the oil. The use of this electric field results in the removal of 90 to 95 percent or more of the salt with the water. Comparative tests show that a much higher proportion of salt is extracted in this manner than when the mixture is separated by other means.

(3) The coalesced water masses are permitted to separate by gravity from the purified oil and form a body of water at the bottom of the treater which contains the salts previously present in the incoming oil. This water is continuously removed from the bottom of the treater, and the separated desalted oil leaves the top of the treater.

Motor Fuels from Polymerization—Gustav Egloff, J. C. Morrell, and Edwin F. Nelson, before AM. PETROLEUM INSTITUTE, Chicago, November, 1937.

The polymerization process is one of the most important developments in the petroleum refining industry. More than 9,000,000,000 gal. of polymer gasoline may be produced yearly from the hydrocarbon gases in the United States, of which more than 1,000,000,000 gal. may be isooctane fuel of 95 to 100 octane rating.

Three modifications of the polymerization process have been described: *a*, polymerization of hydrocarbon gases containing propene and butene; *b*, pyrolytic cracking of butanes (and also propane) to produce olefin hydrocarbons followed by catalytic polymerization to produce polymer gasoline; *c*, selective polymerization of normal and isobutene and hydrogenation of the resulting octenes into isooctanes.

A commercial plant has been described processing daily 13,070,000 cu. ft. of cracked gas containing 19.2 percent of propene-butenes, polymerizing 79.5 percent of these olefins, and producing 1,080 bbl. of true polymer in addition to 974 bbl. of butanes. When treating a cracked gas containing 25.4 percent of propene-butenes at the daily rate of 13,874,000 cu. ft., a total of 1,474 bbl. of true polymer was produced and 1,152 bbl. of butanes. The percentage of propene-butenes polymerized was 86.5 percent. In another commercial plant, treating approximately 1,500,000 cu. ft. of gas per day, containing 38 percent propene-butenes, the production was 250 bbl. of polymer gasoline with a polymerization of 89 percent of the propene-butenes present.

A commercial plant, comprising a combination butane-cracking and catalytic-polymerization process, charges butane at the daily rate of 1,090 bbl., producing 402 bbl. of polymer gasoline made up of 109 bbl. of pyrolytic polymer and 293 bbl. of catalytic polymer gasoline.

A commercial plant has been described treating butane-butene mixtures selectively to polymerize the normal and isobutenes contained therein, having a daily capacity of 1,300 bbl. of butane-butene fraction, from which was produced 347 bbl. of isooctenes. The isooctenes are catalytically hydrogenated to isooctanes, the latter having octane ratings of from 90 to about 100—dependent upon the conditions under which they are produced.

The economic position of the polymerization process for the production of polymer gasoline to improve the octane rating of the refinery output, or as a step in the process of making isooctanes, is now in relatively wide use in the oil industry.

CHEMISTRY

A Decade of Research on the Chemical Constitution of Petroleum—Frederick D. Rossini, before AM. PETROLEUM INSTITUTE, Chicago, November, 1937.

The present report gives a review of the 10 years of research on the chemical constitution of petroleum which has been carried on since 1927 jointly by the American Petroleum Institute and the National Bureau of Standards as the A.P.I. Research Project 6 in the laboratories of the latter institution at Washington. The following subjects are discussed: general method of operation; system of fractionation; methods of identification; separation of a Mid Continent petroleum; summary of the results obtained on the naphtha fraction and the hydrocarbons isolated; results obtained on the lubricant fraction; work in progress; and future problems.

At the current prices listed by the chemical supply houses for the best hydrocarbons (boiling ranges 0.5 to 2 deg. C.) regularly-purchasable for laboratory use, 20 gal. of a Mid Continent straight-run gasoline having a wholesale value of about $1.00, has a potential value of about $1,000 in terms of the amounts of the five normal paraffin hydrocarbons, n-hexane to n-decane, inclusive, which can be separated from it. When the existing laboratory methods for separating hydrocarbons from petroleum are successfully worked out on a commercial scale, the cost of producing these hydrocarbons will be considerably less than those of other processes, synthetic or otherwise. The petroleum chemical industry is now successfully utilizing methane, ethane, propane, n-butane, isobutane, n-pentane, iso-pentane, ethylene, propylene, n-butene, and isobutene, to produce alcohols, glycols, ethers, oxides, aldehydes, ketones, esters, acids, anhydrides, chlorinated compounds, amines, resins, isooctane motor fuel, etc., by the various processes of polymerization, depolymerization, hydrogenation, dehydrogenation, oxidation, halogenation, hydration, dehydration, and alkylation. It is apparent that the range of products can be enormously increased once the use of hydrocarbons of higher molecular weight (six and more carbon atoms) as starting material is made commercially possible by their separation from petroleum. Judging from the recent reports of several groups of investigators, it appears that the separation of a number of important hydrocarbons of more than five carbon atoms per molecule from the gasoline fraction, on a semi-commercial scale and in a state of relatively high purity, is now an accomplished fact.

Reactions of Pure Hydrocarbons in the Presence of Aluminum Chloride—Gustav Egloff, Edith Wilson, George Hulla and P. M. van Arsdell, in CHEMICAL REVIEWS, vol. 20 (1937) No. 3, pp. 345-411.

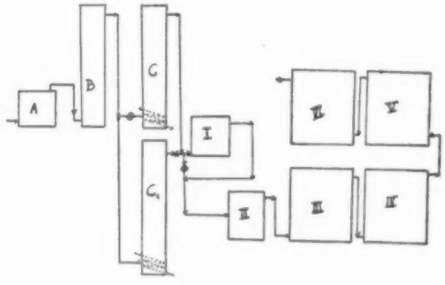
Reactions of pure hydrocarbons of the paraffin, olefin, acetylene, cyclo-paraffin, cycloolefin, terpene and aromatic series which occur in the presence of aluminium chloride are finding application for the production of isomers and lower and higher hydrocarbons. Many studies have been made, and the authors have believed that more information as to the mechanisms of these reactions could be developed by a digest of all the recorded work. They therefore have undertaken a thorough combing of this whole subject and have produced a comprehensive survey of the literature in this field, and in so doing have collated the work of many investigators (153 references).

In the seven main groups of hydrocarbons whose behaviors in the presence of aluminum chloride have been studied, the investigators have found that the reactions of dissociation, dehydrogenation, hydrogenation, isomerization, cyclization, polymerization, alkylation and aromatization play the principal roles with some exceptions. A striking fact stands out, namely, that the butanes, particularly isobutane, are key hydrocarbons resulting from many of these reactions.

Here is apparently a fruitful field for petroleum chemists and technologists of the future, when crude petroleum will become the basis of a vast chemical industry that will supply countless organic products and raw materials for numerous other industries.

Alcohols from Olefines—R. Fussteig, in PETROLEUM, vol. 33 (1937), No. 41, pp. 4-6.

The author has perfected a process for preparing pure alcohols from the corresponding olefins contained in cracked or other petroleum gases. The process depends on the familiar solubility of olefins in sulphuric acid with formation of alkyl esters of sulphuric acid from which the free alcohols are subsequently liberated. As the solubilities of the olefins differ according to temperatures and strength of the sulphuric acid, the process is conveniently arranged as follows (see diagram).



The mixed gas first passes vessel A which contains calcium chloride or other dehydrating agent; mechanical impurities are dropped in the quartz-filled vessel B and the gas enters column C, which is filled with active charcoal. Here all olefins are retained, to be subsequently driven out by steam through vessels I or II where butadiene is removed by copper chloride solution. The finally purified olefins then pass through vessels III, IV, V and VI which are filled with sulphuric acid of 45 deg. Bé, 50 deg. Bé, 60 deg. Bé and 66 deg. Bé, respectively, at the respective temperatures 30 deg., 40 deg., 50 deg., and 60 deg. C. As catalyst, one percent of silver chloride is used. In this way the author has been able to prepare ethyl, butyl and amyl alcohols in pure form.

Study of Reaction Mechanism for Nitration of Paraffin Hydrocarbons—by Rush Fox McCleary with Ed. F. Degering, before PETROLEUM DIVISION AM. CHEM. SOC., Rochester, 1937.

A thorough study was made of the variables which effect the nitration mechanism, and a mechanism postulated, as a result of the data obtained, that will account for the products of the reaction and explain how they are obtained.

As a result of these studies we have concluded that:

1. The reaction appears to involve a free radical mechanism,

2. Oxidation of the paraffin by the nitric acid, or some unstable intermediate, might give free radicals which may undergo any or all of the typical free radical reactions, and

3. The oxidation products may be accounted for through the direct oxidation of the parent hydrocarbon, or by the oxidation of the olefins that are formed by the oxidation of the parent paraffin.

PHYSICS

Determination of Ignitability of Diesel Fuels on a Laboratory Scale—R. Heinze and M. Marder, in JOUR. INST. PETROLEUM TECHNOLOGISTS, vol. 23 (1937), No. 168, pp. 602-614.

In several recently published articles the reliability of the laboratory methods for determining the the ignitability of Diesel oils has been repudiated. In spite of these efforts it has been proved by the above report that, by the proper application of the parachor or density method developed by the authors, cetene values well comparable with those determined by engine tests are obtained. Standard as well as sub-standard testing oils, and also Diesel oils of any origin, as for instance from crudes, lignite tar, coal tar or those manufactured by hydrogenation, by synthesis or by extraction, when tested by the parachor and density method, yielded within very narrow limits the same cetene values as determined by engine test with the aid of the C.F.R. motor.

Based on the analytical and physical constants of the eleven Diesel oils determined by Kreulen, it has been further proved that well agreeing cetene values can be determined not only by means of the parachor and density methods, but also by the aid of numerous other constants, as for instance the Diesel index, the ring-analysis value and also the calorific value, the hydrogen and carbon content, the ratio of carbon-hydrogen and so forth, and cetene values can be obtained by these methods in good agreement with those determined in the testing engine. Besides the constants mentioned, the Siedekennziffer (boiling characteristics number) of the Diesel oils has also a material effect on the determination of the ignitability, and this has not been taken into account in connection with the Diesel index and the ring-analysis method.

The density method for the determination of the cetene value of Diesel oils undoubtedly represents the simplest laboratory test, which is lately being carried out by the aid of the so-called cetene value areometer. On the scale of this instrument the cetene values of the oils under investigation are directly indicated, subject to a correction for the Siedekennziffer.

Experiments on Flow of Liquids Through Sands—F. B. Plummer and J. S. Woodward, in TRANS. AM. INST. MINING AND METALLURGICAL ENGINEERS, (Petroleum Development and Technology) vol. 123 (1937).

This paper discusses briefly the development of methods of measuring the permeability of sands, compares linear and radial measurements, points out special applications of radial permeability determinations, and describes a new method of determining the permeability of unconsolidated sands. Results of experiments on the effect of size of hole on the rate of flow of fluids are discussed. The quantitative effect of depth of penetration of a sand on the rate of flow of oil is described, and the effect of the presence of water mixtures on the rate of flow of oil through sands having different permeabilities is presented in some detail.

Flow of Gas-Liquid Mixtures Through Sands—M. Muskat, R. D. Wyckoff, H. G. Botset and D. W. Reed, in TRANS. AM. INST. MINING & METALLURGICAL ENGINEERS (Petroleum Development and Technology), vol. 123 (1937).

Experimental technique for studying the physical behavior of gas-liquid mixtures in unconsolidated sands is described. The free gas volume was determined by measurements of the electrical conductivity of sections of the sand column. The fundamental empirical data are represented in curves giving the permeabilities to the gas and liquid phases as functions of the fraction of the pore space occupied by liquid. The distinction between the behavior of gas-liquid mixtures in steady-state and transient conditions of flow is brought out, and the relation of the concepts of equilibrium permeability and saturation to the actual production of oil-bearing reservoirs is discussed. An analytical formulation of the empirical results is then given, and solutions for the equations are presented for linear and radial steady-state flow systems. The complete production history of a linear gas- and oil-bearing reservoir is then discussed quantitatively, together with its implications with regard to the questions of well spacing, gas-oil ratio variation, and ultimate recovery.

Modification of the A.S.T.M. Lamp Sulphur Method for Refined Kerosenes—Edward Field and Fred H. Dempster, in IND. ENG. CHEM., vol. 9 (1937), No. 11, pp. 547-550.

The lamp method for the determination of sulphur in petroleum oils, A.S.T.M. Designation D90-34T, has been modified to obtain a considerably greater degree of accuracy on refined kerosenes. It may be used with improved accuracy on other refined oils for which the foregoing A.S.T.M. method is suited. Data are given to show that it is essential to use purified air during burning, a greater amount of sample must be burned, hydrogen peroxide is preferred as an absorbing medium, and if accurate, reliable results are to be obtained, the total sulphur after absorption must be determined by gravimetric means.

USE OF PETROLEUM

Reasoning Behind Diesel Fuel Specifications—I. B. Rendel, in OIL AND GAS JOUR., vol. 36 (1937), No. 22, pp. 67-72.

When broadly considered, the much discussed question of the suitabilities of Diesel fuels is reduced to two basic problems. One is the problem of handling the fuel and dispatching that fuel from the refiner's supply tanks to the final fuel valve which admits the fuel at the proper time and in the proper form of spray to the combustion chamber. The second problem is to supply a fuel at this valve which will burn completely in the combustion chamber without objectionable exhaust smell or leaving objectionable deposits which will eventually result in destroying the mechanical adjustments of the engine thus destroying its mechanical efficiency. Under the first of these problems we have to consider such properties of the fuel as its viscosity, pourpoint, and last, but by no means least, its cleanliness. Under the second problem we have to consider its ignition quality, sulphur content, viscosity, and volatility (which is frequently measured in the case of Diesel fuels by combination of its viscosity and Conradson carbon).

When these problems are duly considered the whole question of Diesel fuel specifications are summed up in the following requirements.

1. Suitable viscosity limits to ensure proper handling of the fuel on its passage to the combustion chamber.

2. Suitable pourpoint limits again to ensure that the engine's pumps can handle the fuel efficiently.

3. Suitable limits for cleanliness as shown by specifications for B.S.&W. and ash content.

4. Suitable limits for ignition quality to ensure adequate control of the first stage of combustion.

5. Suitable limits for volatility as expressed by the Conradson carbon number or other suitable volatility index to be developed.

Consideration of shipping regulations often requires flashpoints or gravity specifications but these do not directly affect engine performance.

Fuel Systems of 1937 Automobiles—T. W. Legatski and R. R. Couch, before AM. PETROLEUM INSTITUTE, Chicago, November, 1937.

In the absence of information on losses from car fuel systems, it has been customary to regard systems as being adequate if they permit trouble-free operation on commercially-obtainable fuels. That this mode of classification is not entirely sound was demonstrated in the course of the Pawhuska road tests, where volumetric losses of fuel varying from 4 percent upwards, depending upon driving conditions, were determined as probable for representative cars. The tests, 251 in number, were run in a cooperative investigation conducted by the Western Petroleum Refiners Association and the Natural Gasoline Association of America.

This loss of fuel in operation is large enough to warrant attention for the further reason that there is an overall corresponding loss of at least one octane number in the residual fuel.

Fuel Oil Production and Use—R. T. Goodwin, before AM. PETROLEUM INSTITUTE, Chicago, November, 1937.

The market for domestic fuel oil has hardly been furrowed. Since 1930 the demand for domestic fuel oils has increased eight times as fast as the demand for gasoline. In this same period the number of oil burners installed increased 103 percent, and it has been shown how this very rapid installation of oil burners in the past few years has changed the refiner's production schedule; and, further, that an adequate supply of fuel oil has been, and will be, available to the consuming public at a reasonable price. There is, however, one definite way in which the oil-burner industry and the fuel-oil distributors can assist the refiners in producing this adequate supply of fuel oil at a fair price. This assistance to the refiner should be in the form of an earnest endeavor by these interested parties to reduce the number of grades of fuel oils now demanded for tank-wagon deliveries. It is well known that we are operating in this country more than 28,000,000 automobiles of numerous makes and models on two primary grades of gasoline. It should be possible to operate all of the 350 or more different makes and models of domestic oil burners on two primary grades of domestic fuel oil. The commercial burners operating automatically and without pre-heaters should be supplied with a grade to meet this service, and still another grade of heavier fuel should be available for industrial use. With this reduction in the number of grades of fuel oil to a total of four,

the refiners can use their full efforts in producing quality fuel oils in volumes sufficient to meet the increasing demands.

It is well recognized that fuel oil must be inexpensive enough to stimulate the sale of oil burners, and must be generally available; and, finally, there must be a sufficient demand for standardized products to interest the petroleum industry in its production and distribution. The petroleum industry fully realizes the importance of producing fuel oils for this rapidly-expanding market, and has been rewarded for this service by an increase in the number of satisfied customers and an unprecedented increase in sales volume.

Finally, when we consider the magnificent technical improvements made in late years in the production, refining, and utilization of fuel oils and their adaptation to the services of mankind, we can look into the future with complete trust in the continued development of this important part of the petroleum industry.

1937 Road Knock Tests—Report from Cooperative Fuel Research Committee, before AM. PETROLEUM INSTITUTE, Chicago, November, 1937.

This paper is a report dealing with the road-test portion of the study of the knock-rating correlation problem. The 1937 tests were made with 57 cars of 13 of the more prominent makes in different parts of the country, using fuels of different knock sensitivity.

From the data it appears that when the ratings of all fuels are included, the motor (A.S.T.M.) method appears to give the best average correlation both in winter and summer. An examination of the correlation charts shows, however, that while the correlation is reasonably good for fuels of moderate sensivities, individual fuels which were either highly sensitive, or which ranged from low to negative sensitivities, deviated appreciably and in a consistent pattern from the average correlation line. The more sensitive fuels were rated above the motor rating on the road, and the less sensitive fuels were rated below the motor rating on the road; so that, with a fairly even distribution of fuels, the plus and minus deviations offset each other in such a way that the averages are in best agreement with the motor (A.S.T.M.) ratings. This does not mean, however, that the motor method gave satisfactory correlation between road and laboratory ratings. On the contrary, the data show beyond any reasonable doubt that certain types of fuels were rated too low by the motor method, and others were rated too high by this method. It can be concluded, therefore, that there is need for a laboratory test method which will give a more satisfactory evaluation of the relative knocking characteristics of all types of fuels than the present motor (A.S.T.M.) method.

To determine the effect of atmospheric temperature on road ratings, similar fuels were rated in the winter and summer in the same cars under approximately the same conditions. The results indicate that there is an average difference of 0.4 of an octane number between the summer and winter ratings of the fuels.

Effect of Test Conditions on Fuel Rating—Report of Cooperative Fuel Research Committee to AM. PETROLEUM INSTITUTE, Chicago, November, 1937.

The work here reported covers the following:

1. Standardization of knock intensity for the various conditions of test. To facilitate comparison of results, it was decided to make all tests at a knock-intensity level comparable to that of the motor method.

2. The relationship between spark advance and power, and between spark advance and knock, throughout the compression-ratio range used in making octane ratings. This was done at several speeds and two mixture temperatures.

3. The effect of the following variables on the ratings of a selected list of the *W* fuels, as defined below.

   a. Speed, —600, 900, and 1,200 r.p.m.

   b. Mixture temperature, —300, 200, and 150 deg. F.

   c. Constant spark advance, —26, 17, and 10 deg. F.

From the results it is deduced, *inter alia*, that for the non-sensitive fuel, WA-1, it is apparent that the combined effects of speed and mixture temperature are to lower the ratings at low speed and low temperature as compared to the motor method; and also, at 10-deg. spark advance, to a lesser degree at high speed and high temperature. As the spark is advanced, the effect of high speed and high temperature is reduced; whereas spark advance appears to have no effect at low speeds and temperatures.

For the sensitive fuel, WG-1, the combined effect of high speed and high temperature is to reduce materially the rating. The effect of advancing the spark setting is to increase slightly the rating at high speed and high temperature, but to reduce it at low speed and low temperature.

For the fuel of intermediate sensitivity, WB-3, the combined effect of high speed and high temperature is to reduce the rating. In general, spark advance has little effect.

In the case of a non-sensitive fuel, it will be observed that there are a large number of combinations of speed, temperature, and spark advance that result in approximately the same rating. Thus the rating of such a fuel can only be changed through a narrow range. As fuel sensitivity increases, ratings are more critical to the variables under discussion. although there are less combinations that can be used to produce a given rating, the range of ratings obtainable by changing engine variables is much greater.

The reactions of fuels of different types to engine variables have a direct bearing on the possibility of obtaining good correlation between road and laboratory ratings. To obtain such correlation with a single-engine method, combinations of engine variables to produce ratings equivalent to road values for each fuel must have at least one common combination.

PETROLEUM SUBSTITUTES

Producer Gas (Gasogene) Vehicles in France—Oskar Tokayer, in PETROLEUM PRESS SERVICE, vol. 4 (1937), No. 43, pp. 513-515.

Recently there has been a recrudescence in France of active propaganda in favor of the producer gas vehicle, conducted, in the present case, by the Ministry of Agriculture, with the support of the military authorities and the timber interests. In view of the fact that oil-from-coal schemes have not matured beyond the production of some 30,000 tons of gasoline a year, the demand for a national fuel supply is now being directed more and more to the possibilities of wood gas. With the heavy increase in Diesel oil duties and the tax exemption granted to producer gas vehicles, the most important commercial motor manufacturers have recently given considerable attention to the construction of the generator type of engine.

The present figure of privately owned wood gas vehicles in France is estimated at about 3,500 plus 1,000 in possession of the military authorities. Whether the number will increase to an extent that would constitute a serious threat to the gasoline and oil trade appears doubtful, because of the limited timber resources of the country. If every stick of wood annually produced in France were converted into charcoal, about 500,000 tons of oil might be displaced, but this is only little more than a tenth of the country's oil requirement, and the displacement of this oil in that manner would leave no timber for other purposes.

PETROLEUM ECONOMICS

Immediate Prospects of the American Petroleum Industry—Oskar Tokayer, in PETROLEUM PRESS SERVICE, vol. 4, (1937), No. 37, pp. 445-448.

If the possibility of a major recession is left out of account entirely, the present situation demands of the petroleum industry, as of industry in general, the exercise of the utmost caution in regard to its operations. Above all, the oil industry will be well advised not to base its arrangements on the presumption that requirements of oil products will continue to expand at the present rate. It has already been noticeable during the past few months that the industry takes the enormous additional demand too much as a matter of course and is, therefore, inclined to increase its operations somewhat lightheartedly.

Granted this need for somewhat closer vigilance in the adjustment of operations to actual requirements, the oil industry is probably better placed than most others and able with less sacrifice to adapt itself to an unfavorable development of the economic situation.

On the basis of motor car sales in recent months there is likely to be a total of 30,000,000 vehicles in circulation on January 1st, 1938, as against 28,221,000 at the beginning of 1937. Moreover the undoubtedly more intensive use being made of motor transport is resulting in an increase in gasoline consumption even more rapid than in the number of vehicles. Even in relatively unfavorable economic conditions, the year 1938 should see a further increase in demand for gasoline.

As far as heavy oils are concerned, things are somewhat different. A decline in business activity would adversely affect the demand from a number of different industries, and it is possible that the requirements of inland and coastal navigation, as well as, to a lesser extent, those of the railways, would also be smaller. Demand for heavy oils for domestic heating is steadily increasing and this expansion is less sensitive to the ups and downs of trade cycles than motor traffic, since oil heating equipment, once installed, is almost certain to be kept in use during the winter. Loss of business in this section is liable to occur only to the extent of any reduction in the number of new oil burning apparatus installed. Heavy oil sales for domestic heating purposes have now come to represent so important an item in the total deliveries of the oil industry that they could largely offset losses in other fields.

In this respect the position of the oil industry has undergone a fundamental change since 1929, which has undoubtedly resulted in diminished dependence of heavy oil demand on economic conditions. Sales of gas and fuel oils fell heavily in 1930—to 368,245,000 bbl. from 415,156,000 bbl. in 1929, but at that time there was a comparatively small demand for heavy oil for Diesel engines, while fuel oil requirements for heating were of negligible proportions. The bulk of the sales, which consisted mainly of residual fuel oil, were made to industry, railways and shipping. Today the heavy oil business rests on a much broader basis.

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GULF EXPORT PRICES FOR MAJOR OIL PRODUCTS

Products		Nov. 23	Nov. 30	Dec. 8	Dec. 15
		Cents Per Gallon			
GASOLINE:	U. S. Motor	5½	5¼	5¼	5¼
	64/66-375 E.P.	5⅝	5½	5¼	5¼
	59 Octane and below	5½	5¼	5¼	5⅛
	65 Octane and above	5⅞	5⅞	5⅝	5⅝
AVIATION GASOLINE:	Gulf Export in cargo lots	9½	9¾	9¾	9¾
KEROSENE:	44 w.w.	5⅝	5⅝	5½	5½
	44/43 w.w.	5¼	5¼	5⅛	5⅛
	41/43 p.w.	5⅛	5⅛	5	5
GAS OIL:	26-30 translucent	4⅜	4⅜	4⅜	4⅜
	30 plus translucent	4½	4½	4½	4½
		Dollars Per Barrel			
FUEL OIL:	Bunker C	95	95	95	95
	Cargo lots	85	85	85	85
	Diesel oil	1.90	1.90	1.90	1.90
		Cents Per Gallon			
LUBRICATING OIL:	Bright Stock No. 8	23½	23½	23½	22½
	Bright Stock No. 6½	23	23	23	22
	600 Warren E	20½	20½	20½	20½
	600 Unfiltered s.r.	15½	15½	15½	15
(New York Export Market)	650 Unfiltered s.r.	19	19	19	18
	600 Flash s.r.	19½	19½	19½	18½
	630 Flash s.r.	23½	23½	23½	22½
	Neutral 200 No. 3	28	26	26	26
	Neutral 150 No. 3½	24	24	24	24
(South Texas Export Market)	Red oil 500 No. 5-6	8¾	8¾	8¾	8¾
	750	9¼	9¼	9¼	9¼
	1200	9¾	9¾	9¾	9¾
	Pale oil 500	8¾	8¾	8¾	8¾
	750	9¼	9¼	9¼	9¼
	1200	9¾	9¾	9¾	9¾
		Dollars Per Barrel			
CRUDE OIL:	East Texas delivered at Gulf for export	1.52	1.51	1.51	1.51

FREIGHT RATES

	Nov. 23		Nov. 30		Dec. 8		Dec. 15	
	Dirty	Clean	Dirty	Clean	Dirty	Clean	Dirty	Clean
	Shillings Per Ton							
Gulf—U.K./Continent	20/-	31/-	20/-	31/-	20/-	30/-	20/-	30/-
California—U.K./Continent	—	—	—	—	—	no bookings	—	—
Aruba—U.K./Continent	17/-	19/6	—	—	17/-	19/6	18/-	19/6
North Atlantic—U.K./Continent	17/-	20/6	—	27/6	18/-	27/6	18/-	27/6

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Official Figures for Soviet Oil Operations

	Crude Production (Bbl.)	Daily Average (Bbl.)	Run to Stills (Bbl.)	Drilling (Ft.)
January	16,117,461	519,918	14,412,330	443,310
February	13,796,325	492,726	12,671,478	359,317
March	15,907,051	513,130	14,375,151	540,510
April	16,401,771	546,722	14,386,086	542,390
May	18,130,230	584,846	16,997,778	591,510
June	17,953,812	598,460	17,144,724	585,182
July	18,580,752	599,379	17,902,782	572,441
August	15,830,000	527,667	14,790,000	520,000
September	16,663,000	537,516	15,100,000	530,000
October	17,600,000	567,742	15,830,000	530,000
November	16,923,000	564,100	15,413,000	510,000
Total 11 Months, 1937	183,903,402	550,609	169,023,329	5,724,660
Total 11 Months, 1936	182,542,849	544,904	165,851,018	6,327,087
Total 1936	199,634,921	545,450	180,582,274	6,958,916
Total 1935	184,007,619	504,130	152,783,726	4,858,465
Quota 1937	234,450,000	642,329	208,285,000	9,240,000
Quota 1936	222,345,000	607,500	182,250,000	7,100,000
Quota 1935	221,106,000	605,769	178,605,000	5,214,000

Increases in Soviet gasoline production are not in keeping with the growth of demand. Output during the first six months of 1937 is only 75 percent of the quota for the period, and is below the corresponding figure for the first half of 1936. Failure of the Russian petroleum industry to keep in step with the automotive and other heavy industries, plus the steady expansion of transportation on land and in the air, have led the central executive committee of the council of people's commissars to decree that all economic organizations must decrease consumption of oil fuel by not less than 12 percent; and that delivery of motor fuel to motor vehicles be practically rationed.

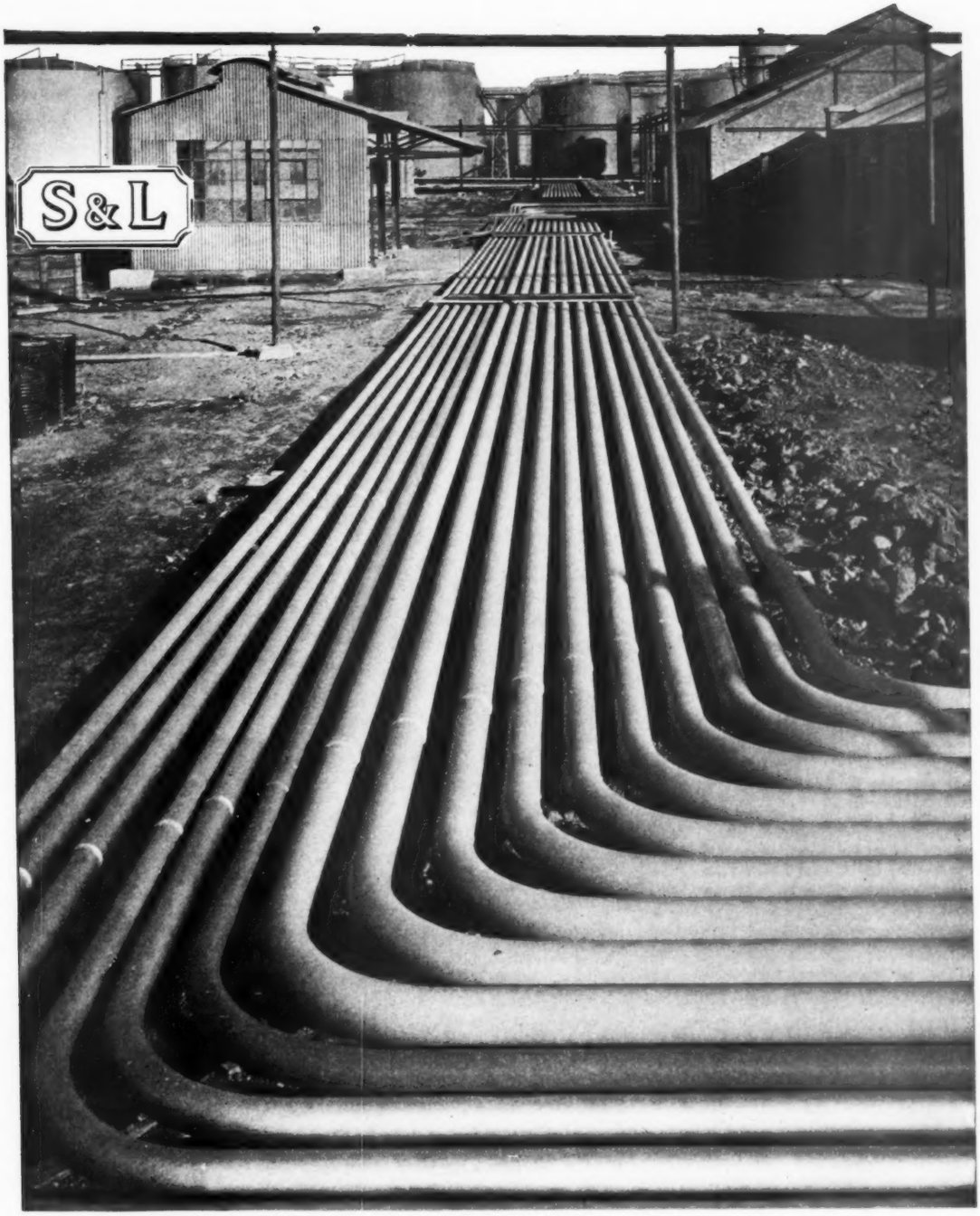
Soviet Gasoline Production

(Barrels)

1930	16,719,500	1934	23,927,500
1931	18,878,500	1935	26,350,000
1932	23,630,000	1936	35,802,000
1933	22,525,000	1937 (6 mos.)	16,830,000

Decreasing shipments of gasoline abroad were evident during the Second Piatiletka, despite the fact that it is the most remunerative product for export. Shortage has rendered it necessary for the Soviets to augment their domestic supplies with American gasoline, most of which is shipped to Vladivostock. It is also more advantageous for the Russian Far East to import gasoline from California than to haul it from the Black Sea. During the first nine months of 1937 a total of 935,000 bbl. of gasoline were transported across the Pacific to Soviet territory, compared with 391,000 bbl. in the corresponding period of 1936.

(Continued on page 70)



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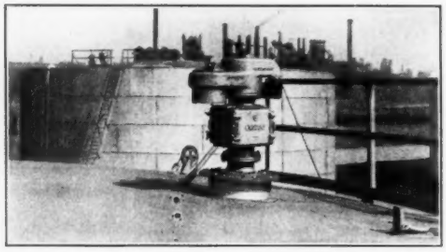

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(Continued from page 68)

The grade shipped does not appear to indicate any particular use, such as for aviation, as it is ordinary export gasoline 61/63 A.P.I. with normal octane rating.

Soviet Gasoline Exports

(Barrels)

1930	13,234,500	1934	9,519,575
1931	14,076,850	1935	7,195,975
1932	17,148,750	1936	3,616,750
1933	11,016,000	1937 (9 mos.)	2,620,142

Soviet oil exports have been on the decline since 1932. Will Russia ever return to its former position in the European markets? While it has an advantageous geographical position to Europe, and to a certain extent to the Near and Far East, there have been radical changes in source of supply during the period Russia has been declining in importance. The prewar Russian oil industry began to lose its markets in Europe and the East until by 1905 it had practically none—but in due course it was able to regain these. The markets of the time were wide open to Russia, for the major consuming countries had neither natural resources nor refining facilities adequate to supply their needs. Postwar Europe has ordained a wide-spread policy of self-sufficiency—Germany, Italy, France and England have built up their domestic refining industries and are large importers of crude oil, while substitute fuels are used increasingly. It therefore remains a question as to whether the Soviet will be interested in supplying crude, which at present it is not. When, and if, the country is able to increase its petroleum production so as to create a surplus for export, then will it prove profitable to ship crude to the open market in the face of competition on the part of Bahrein and other cheap sources?

As the end of 1937 approaches it appears a certainty that the Soviet oil industry will not be able to live up to plan—arrears in crude production have been officially estimated at 22,900,000 bbl. while drilling and refining show large deficits. As the past twelve months form the last and decisive year of the Second Piatiletka it means that the Five Year Plan has not been attained and that not a single year between 1933 and 1937 has shown fulfillment of its quota. This is despite the fact that the annual quotas have been constantly revised downwards when it became apparent that the industry could not come up to requirements.

ZA INDUSTRIALIZATIU for November 28th, 1937, reports that "during a meeting of the executives, comrade Iskanderov, the present head of Glavneft, deprecated the unsatisfactory condition of the petroleum industry during the first ten months of the year. The arrears in crude oil production are due as much to insufficient drilling for production as to lack of exploratory drilling. Drilling speed is too low, as is evidenced by the fact that average rate per tablemonth is only 2,000 ft., instead of 3,112 ft. as originally planned.

"Idle wells in the Soviet oilfields are hindering progress to a considerable extent —of 4,000 non-producers some 1,500 wells were to be reconditioned during the year, but to date only 570 have been repaired and not all these are on full-time operation. Shut-downs of three or four hours daily are not uncommon, which are bound to cause a loss of several million barrels per year. The refineries are also behind plan, and have arrears of about 10,000,000 bbl. during the first ten months of 1937. It is a well-known fact that wreckers in the Soviet oil industry have done their utmost to hinder progress in crude production and run to stills, and it is most unfortunate the ill effects are being removed so tardily.

"Reorganization of Glavneft is proceeding slowly due to shortage of men qualified to fill the vacant positions. There are insufficient engineers for the dispatch department and the technical division, as well as not enough for the construction department."

The journal goes on to state that 20 speakers took part in the discussions following the report of Iskanderov. From this discussion it became evident that this main division of the Russian oil industry lacked the qualities necessary for co-operative effort among its subsidairies and further loss of cohesion was effected by the radical changes in personnel. Many of the new staff members in the various departments are entirely lacking in knowledge of their jobs.

With Iskanderov at the helm of Glavneft it is now evident that Barinov is to be numbered among the long list of Soviet executives whose fate is unproven but strongly suspected. Likewise, the assistants who have been with him for the past 18 years, first at Azneft and later Glavneft, have apparently also gone. Removal of Barinov, it will be recalled, was predicted in these columns in our issue of October, 1937.

Statistics for November reveal that crude oil production from Soviet oilfields was about 90 percent of plan at the beginning of the month, but dropped to about 86 percent at its close.

Soviet Oilfield Plan Fulfillment During November

Field	High	Low
	Percentage	
Baku	95.2	90.0
Grozni	79.0	77.4
Maikop	108.0	102.0
Emba	80.0	75.0
Bashkiria	68.0	59.0
Others	66.0	56.0

Although it is evident that the production quotas are far from satisfactory, it is not unusual for Soviet drilling activities to fall off at this time of year. Drilling plan was fulfilled from 52 to 60 percent during November. On individual days Grozni, Maikop and Emba attained 124, 154, and 125 percent of plan, respectively.

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(Continued on page 72)

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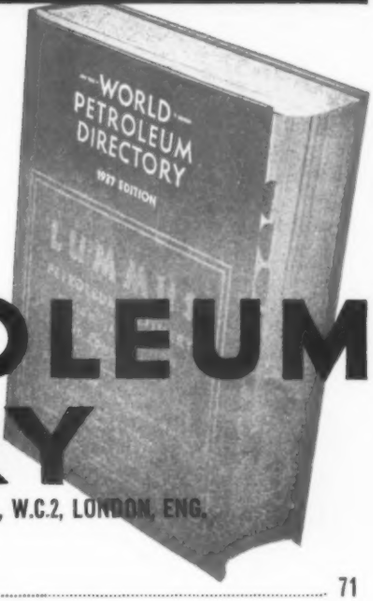

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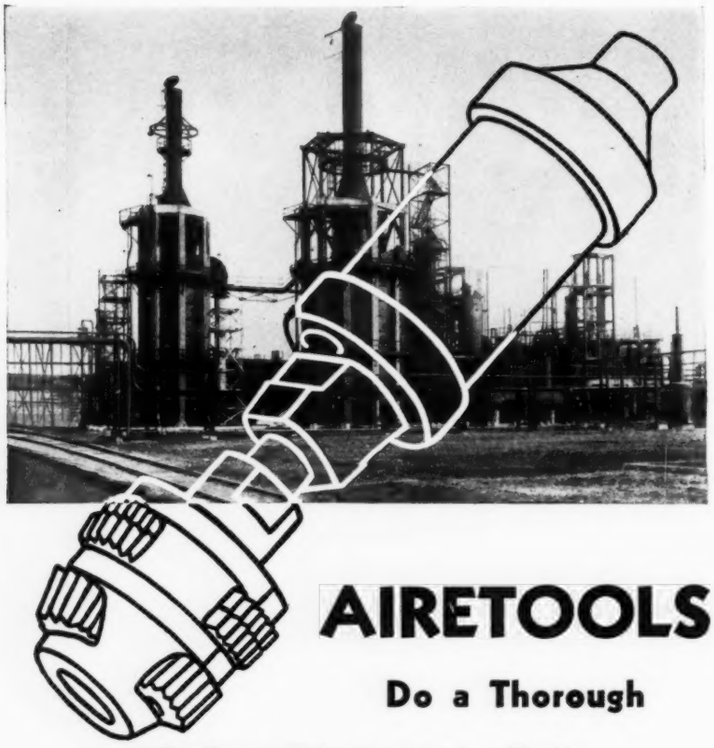

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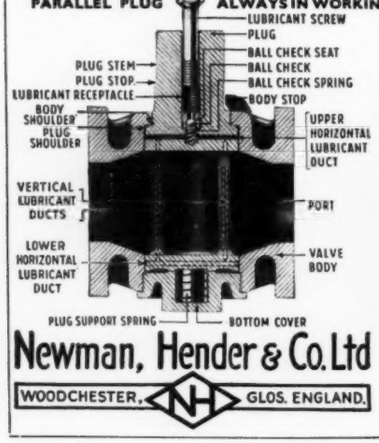

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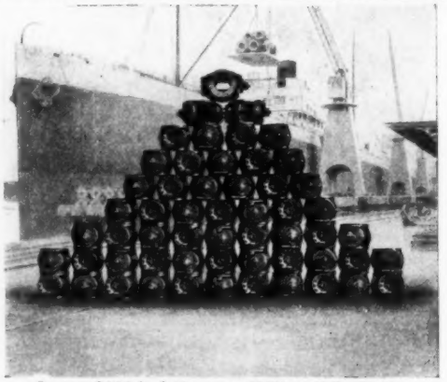

Group of 56 8-inch Newman-Milliken Valves being shipped to an Australian order

(Continued from page 70)

been shown at Maikop, where new production has been obtained. ZA INDUSTRIALIZATIU for November 23rd, 1937, reports that "the new field obtained at Asphalt Mountain, from which about 40 percent of Maikop output is obtained, is estimated by the geologists to have reserves of at least 14,600,000 bbl. of crude. The discovery well was drilled in July, 1936, and the 30 wells now located in the region have a total daily average of nearly 15,000 bbl. The drilling has been done by the more expert drillers of Maikop, whose speeds have reached 6,665 ft. per table-month. To date production is obtained only from flowing wells, but a compressor station is being installed for operation during 1938.

"These successes show clearly that wreckers have held back for a long time the completion of flush wells. Party members and other loyal Maikop operators are trying hard to bring the production of the new field up to 22,000 bbl. per day, but they are getting little assistance in their efforts from the main offices of Maikop. The pipeline must be completed early in December lest the oil from new wells be lost, and inadequate water supplies are handicapping drilling operations. Another important item for consideration is the condition of roads, as the first autumn rains indicated how readily the field may be cut off from its base at Neftegorsk, 24 miles away. Neither horse nor tractor are able even to traverse the quarter-mile road from the field to the drilling shop and warehouse during the rains.

"The drilling crews at Asphalt Mountain field are first class workers, yet they are neglected—housing and supplies are poor, and the restaurant is badly managed. The officials of the oil industry should learn that any region capable of crude oil production should be treated with greater consideration."

The same journal in its issue of November 24th, 1937, mentions that the officially liquidated, or shut-down, wells represent a large reserve capable of increasing the total daily average production of Soviet oil. In most cases they have never been dismantled and require only minor repairs or cleaning. During Soviet operation of the Apsheron fields thousands of wells were written off; Ordzonikidze group has 600 and Stalin group some 800. It would appear that the almost inexhaustible oil resources of the Apsheron turned the minds of the operators in Baku, and that they have an aversion to small producers. "Today, when production becomes increasingly difficult, many will overlook a well which produces from 10 to 140 bbl. daily. Aspirations for strongly flowing wells are predominant, and because

(Continued on page 74)

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(Continued from page 72)

of these sentiments many small producing wells have been dismantled and their equipment removed. Wreckers have done much to increase this neglect further—to spend money and effort drilling a well and immediately shut it down is the policy of saboteurs.

"It is quite possible to open up these wells for production—in the Kirov group of Baku at least a third of the so-called liquidated wells are again being operated, and other oilfield groups are doing likewise. There is another category of shut-down wells, namely, those inactive due to shortage of equipment. In the Stalin group alone there are 140 of this type. Evidence of the inaction in many of the Russian oilfields is given by the fact that although the Stakhanovites had pledged to increase production by increasing the number of producing wells during twenty days late in October and early November, not much improvement was effected. Because of the enforced shut-down of existing wells the actual increase was only 101 wells, yet 335 producers were completed in that period. In some fields, although an appreciable number of new wells are drilled, the total quantity of producers continues to decline. The problem of increasing crude oil production was discussed by the former management as it is being discussed by the new authorities of Baku, but so far without any results."

Almost all Soviet oilfields with the exception of Baku are in undeveloped territory—some are in the steppes and others in the mountains. Natural conditions such as lack of water, sparseness of vegetation, difficulty of communication and transport make it increasingly hard to exploit the subsoil. These same difficulties hamper the preliminary exploratory work, and for this reason one wonders just how accurate are the estimates made by Soviet authorities? Emba, for example, is to become the foundation of the second Soviet oil base in the East. Apart from estimates made on the field's resources on the basis of ten or twelve salt domes studied, what investigations have been made? I. Gubkin states that there are about 1,000 such salt domes to be found in Emba, and therefore it is suggested that it would be easy to produce 36,000 bbl. annually from each dome, and that it is possible to obtain 36,000,000 bbl. of petroleum each year from the region. Even granting that the geological conditions are as favorable as has been intimated, nay, openly stated, by Soviet geologists; it is doubtful in view of past experiences whether the Russians will be able to so coordinate their activities as to make available sufficient trained men and the equipment for them to use. ■ ■ ■ ■ ■

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